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**FINAL PLAN
AND
FINAL ENVIRONMENTAL
IMPACT STATEMENT**

CEDAR RUN WATERSHED

FAUQUIER COUNTY, VIRGINIA



**U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE**



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ADDENDUM

CEDAR RUN WATERSHED PLAN

FAUQUIER COUNTY, VIRGINIA

DISCOUNT RATE COMPARISON ^{1/}

Using an interest rate of 6-1/8 percent, annual project costs are \$251,760; benefits, excluding local secondary benefits are estimated at \$417,650, giving a benefit-cost ratio of 1.7 to 1.0. Inclusion of local secondary benefits increases the annual benefits to \$432,360, and the benefit-cost ratio to 1.7 to 1.0.

December 1975

^{1/} Price Base: 1974, See page I-37.

U. S. DEPT. OF AGRICULTURE
NATIONAL COMMISSION

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FINAL PLAN
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT
CEDAR RUN WATERSHED
FAUQUIER COUNTY, VIRGINIA

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended, and in accordance with the National Environmental Policy Act (Public Law 190, 91st Congress, 83 Stat. 853., section 102(2)(C)).

Prepared by:

John Marshall Soil and Water Conservation District
Fauquier County Board of Supervisors
Town of Warrenton
Forest Service and Soil Conservation Service of the
U.S. Department of Agriculture
Virginia Division of Forestry

December 1975

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PART I

FINAL PLAN

CEDAR RUN WATERSHED

FAUQUIER COUNTY, VIRGINIA

WATERSHED PLAN AGREEMENT

between the

John Marshall Soil and Water Conservation District

Fauquier County Board of Supervisors

Town of Warrenton

(hereinafter referred to as the Sponsoring Local Organization)

State of Virginia

and the

Soil Conservation Service

United States Department of Agriculture

(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Cedar Run Watershed, State of Virginia, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Cedar Run Watershed, State of Virginia, hereinafter referred to as the watershed plan, of which this agreement is a part;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed plan, and further agree that the works of improvement as set forth in said plan can be installed in about eight (8) years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed plan;

1. The town of Warrenton has secured the landrights valued at \$105,100 for the construction of structure number 3. Fauquier County will acquire, with other than P.L. 566 funds, such landrights as will be needed in connection with the construction of all other works of improvement at an estimated cost of \$935,250.

2. The sponsoring local organization responsible for securing land rights for each structure assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the responsible sponsoring local organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation Payments	43.3	56.7	13,000

3. Fauquier County will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

<u>Works of Improvement</u>	<u>Fauquier County</u> (percent)	<u>Town of Warrenton</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Costs</u> (dollars)
Floodwater Retarding Structures No. 1, 2, 5, and 7	0	0	100	776,000
Multiple-purpose Structure No. 3	0	30.43	69.57	306,800
Raw Water Intake	0	100	0	26,410
Multiple-purpose Structure No. 4	10.50	0	89.50	503,250
Raw Water Intake	100	0	0	33,570
Multiple-purpose Struc. No. 6	13.42	0	86.58	862,600
Raw Water Intake	100	0	0	38,950

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Fauquier County</u> (percent)	<u>Town of Warrenton</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Costs</u> (dollars)
Floodwater Retarding Structures No. 1, 2, 5, and 7	0	0	100	60,140
Multiple-purpose Structure No. 3	0	30.43	69.57	18,780
Raw Water Intake	0	100	0	3,000
Multiple-purpose Structure No. 4	10.50	0	89.50	30,800
Raw Water Intake	100	0	0	3,400
Multiple-purpose Structure No. 6	13.42	0	86.58	39,250
Raw Water Intake	100	0	0	4,000

6. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$35,100 and \$304,280, respectively.

7. The John Marshall Soil and Water Conservation District will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation plans on their land.

8. The John Marshall Soil and Water Conservation District will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed plan.

9. The John Marshall Soil and Water Conservation District will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. The town of Warrenton will be responsible for the operation and maintenance of multiple-purpose structure number 3. Fauquier County will be responsible for the operation and maintenance of all other structural works of improvement. The responsible sponsor will accomplish the operation and maintenance by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

John Marshall Soil & Water Cons. Dist. By Edwin F. Gulick

Local Organization

22 Hotel St., Warrenton, Va. 22186

Address

Zip Code

Title

Chairman

Date

12-19-75

The signing of this agreement was authorized by a resolution of the governing body of the John Marshall Soil and Water Conservation District (local organization) adopted at a meeting held on December 12, 1975

L.S. McNamee

Secretary, Local Organization

Warrenton

Address

22186

Zip Code

Date 12-19-75

Fauquier County Board of Supervisors

Local Organization

14 Main St.

Warrenton, Va.

22186

Address

Zip Code

By James F. Austin

James F. Austin

Title

Chairman

Date

12-19-75

The signing of this agreement was authorized by a resolution of the governing body of Fauquier County, Virginia (local organization) adopted at a meeting held on December 11, 1975

J.H. Pearson, Clerk

Secretary, Local Organization

Warrenton, Va.

Address

22186

Zip Code

Date 12-19-75

Town of Warrenton
 18 Court St.
 Warrenton, Va. 22186
 Address Zip Code

By J. W. Lineweaver
 J. W. Lineweaver
 Title Mayor
 Date 12-19-75

The signing of this agreement was authorized by a resolution of the governing body of the Town of Warrenton (local organization) adopted at a meeting held on 12-18-75

Mary C. Matter
 Secretary, Local Organization
 Date 12-19-75

Warrenton, Va. 22186
 Address Zip Code

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
 United States Department of Agriculture

Approved by:

R. K. Lineweaver
 State Conservationist
 Date 3/7/76

WATERSHED PLAN

CEDAR RUN WATERSHED

FAUQUIER COUNTY, VIRGINIA

December 1975

SUMMARY OF PLAN

This plan was prepared by the John Marshall Soil and Water Conservation District, the town of Warrenton, and the Fauquier County Board of Supervisors, the sponsoring local organizations. Cedar Run watershed project area, containing 65,517 acres, is located in Fauquier County, Virginia.

Because of the flood hazard, the agricultural use and management of large areas of the flood plain lands of Cedar Run are severely limited. When not subject to flooding, these lands respond well to improved agricultural management practices, produce high yields of crops such as corn, hay, and small grain, and are less subject to erosion than uplands. Other problems caused by flooding include damage to highways, public utilities, and farm improvements; erosion of the uplands; and sedimentation of the bottom lands. Orderly urban growth and planned development in the area outside the flood plain is restricted by the lack of an adequate municipal water supply system. Average annual damages are estimated to be \$141,895.

These problems will be alleviated through the application of an overall watershed management plan. Acceleration of land treatment measures in addition to the going program and the installation of three multiple-purpose structures and four floodwater retarding structures will reduce average annual damages 66 percent and provide 2,000 acre-feet of municipal and industrial water storage for the town of Warrenton and Fauquier County. The seven structures will also control the runoff from 62.4 percent of the watershed and store sediment and floodwater.

Resource inventories and evaluations will be made and land treatment measures will be installed on 4,550 acres of cropland, 8,200 acres of grassland, 9,776 acres of forest land, and 420 acres of land in other uses. Planned land treatment measures include 150 acres of wildlife upland habitat management. The district will give priority to requests for technical assistance in installing land treatment measures in the watershed.

Land use adjustments on the flood plain and other management practices, made possible by the project, will provide greater profit margins for farm operations. Therefore, the people affected will have the opportunity to improve their standard of living.

Public access to the Licking Run and Auburn sites (sites 4 and 6 respectively) will provide fishing and recreational opportunities for an estimated 20,000 people annually. Opportunities for urban developments will improve with the establishment of an adequate public water supply and distribution system.

It is estimated that the project can be installed in 8 years at a total cost of \$4,899,260. Public Law 566 funds will provide \$2,779,594 and other funds \$2,119,666 of this cost. Land treatment measures are estimated to cost \$799,580, with Public Law 566 funds providing \$146,500 for accelerated technical assistance, and other funds \$653,080 for installation costs and technical assistance to continue the going programs. The estimated installation cost of the seven dams is \$4,099,680, with Public Law 566 funds bearing \$2,633,094 and other funds \$1,466,586. Of the amount supplied from other funds, \$1,040,350 will be used to acquire landrights; \$391,136 will pay for engineering services and construction that will provide 2,000 acre-feet of municipal water storage, and the relocation costs associated with structure number 6; and \$35,100 will be used for project administration.

In recent years the landowners and operators have installed land treatment measures at an estimated cost of \$1,970,848 in addition to the measures proposed in this plan.

The John Marshall Soil and Water Conservation District will coordinate installation of this project. Land treatment measures will be installed by owners and operators within the watershed, through conservation plans developed in cooperation with the District. The Soil Conservation Service, and the Virginia Division of Forestry through cooperative programs with the U.S. Forest Service, will provide technical assistance as needed. The Fauquier County Agricultural Stabilization and Conservation Committee will assist in acceleration of planned land treatment, by giving special consideration to requests for measures eligible for cost-sharing, within the limits of funds available.

The town of Warrenton has secured the landrights and will provide the nonfederal share of the installation costs for structure number 3. Fauquier County will do the same for the remaining six sites. Investigation by the sponsors has revealed that one family will be displaced by the installation of structure number 6. Fauquier County will meet all applicable requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 in this relocation. The Soil Conservation Service will secure the engineering services for structure number 3 by means of a negotiated

A&E contract with a consulting firm that is acceptable to both the town of Warrenton and the Soil Conservation Service. The Service will also let and administer contracts for this structure. Fauquier County intends to request that the Soil Conservation Service let and administer contracts and provide engineering services for structures 1, 2, 4, 5, 6, and 7. The sponsors will provide inspection services deemed necessary for their respective sites to assure that all project features will meet contract requirements and function properly. Fauquier County will, at its expense, provide necessary access, parking, and sanitary facilities to allow use of sites 4 and 6 for recreational purposes.

The Soil Conservation Service will review the work performed by the A&E contractor, administer construction contracts, and provide inspection services deemed necessary on all items of construction on which P.L. 566 funds are spent and any other items of construction which may affect the function or stability of the structure. The Soil Conservation Service will also provide the clerical, administrative, and related services that their activities require, and bear the cost it incurs.

Operation and maintenance of the dam at site number 3 will be performed by the town of Warrenton at an estimated average annual cost of \$1,500. Operation and maintenance of the other six dams will be performed by Fauquier County at an estimated average annual cost of \$8,000. Land treatment measures will be maintained by the land-owners and operators through agreements with the John Marshall Soil and Water Conservation District.

Average annual benefits from all planned structural measures are estimated at \$433,470. (See tables 5 and 6). The average annual cost of structural measures is estimated at \$251,176, resulting in a benefit-cost ratio of 1.7 to 1.0.

All information and data, except as otherwise noted, were collected during the watershed planning investigation conducted by the Soil Conservation Service, and Forest Service, of the U.S. Department of Agriculture.

INTRODUCTION

This plan has been edited to avoid excessive duplication of information contained in the Environmental Impact Statement. Part II should be reviewed for additional information on project formulation, problems, alternatives, environmental impacts, and use of resources.

PLANNED MEASURES

Resource inventories and evaluations will be completed on about 420 acres. About 100 conservation plans, 98 multiple use forest management plans, 12 plan revisions and 160 inventory evaluations will be prepared with landowners for conservation treatment and management of their land. Conservation treatment included in plans designed to improve land cover, reduce erosion, improve production, enhance fish and wildlife habitat, etc., will be applied on 4,550 acres of cropland, 8,200 acres of pastureland, 9,776 acres of forest land and 420 acres of other land. Acceleration of technical assistance to landowners for planning and application of land treatment measures will be required to accomplish the goals of the planned project within the eight-year installation period. Approximately 30 percent of the planned measures can be accomplished by going programs. Accomplishment of the remaining 70 percent of these measures during the project installation period will be dependent on project funds in the form of accelerated planning and application assistance to landowners. These accelerated technical assistance costs are estimated to be about 18.3 percent of the planned project land treatment costs.

Seven reservoir type structures will be installed; four are floodwater retarding structures and three are floodwater retarding-municipal water supply structures. Each reservoir dam will consist of a zoned earth fill with a reinforced concrete principal spillway system and an emergency spillway in a vegetated earth or rock cut. The structures are designed with capacity to store expected sediment accumulations at each site over a 100-year period. Water supply capacity is based upon needs established. The size of the principal spillway and crest elevation of the emergency spillways are designed to accommodate runoff from the 100-year storm event without flow through the emergency spillway. The emergency spillways are designed to pass flows in excess of runoff from the 100-year storm event without significant damage to the spillway or dam. A water supply intake riser and a water main outlet will be installed at each of the three multiple-purpose sites. Three gates will be installed on each riser to allow release of water from a selected depth.

The Virginia Historic Landmarks Commission and State Historic Preservation Officer have indicated that construction of the proposed project would not impact known archeological or historic values and that there is little likelihood that such values exist within the areas to be disturbed by construction. Even so, these offices and the National Park Service will be notified in the event any evidence of cultural values are discovered during detailed investigations or construction. Procedures outlined in P.L. 93-291 will be followed. Since this is a federally assisted local project, there will be no changes in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archeological and historic resources.

Landrights will be acquired on 1,421 acres of land and 218 acres will be cleared of cutover hardwood and brush for installation. The sediment and water supply pools will occupy 486 acres; the detention pools 672 acres; emergency spillway storage 153 acres; and earth fills, emergency spillways and construction areas 110 acres. Pollution from erosion and sedimentation will be minimized during construction through scheduling of operations and use of approved control measures. All disturbed areas will be seeded to adapted grasses and legumes, tree seedlings or shrubs consistent with function and desired appearance immediately upon completion of construction.

A 12-inch slide gate will be installed 5 feet above the base of risers on structures 4 and 6 for flow management.

The lakes of structures 4 and 6 will be stocked with fish, public access will be provided and recreation and sanitary facilities will be installed by Fauquier County for incidental recreation and fishing use by the public.

The sponsors plan to monitor the water quality at each of the multiple-purpose sites on a continuing basis, and will take any necessary actions to insure that the intended beneficial uses can be realized.

All works of improvement installed will comply with applicable federal, state and local laws and regulations.



USDA-SCS-HYATTSVILLE, MD, 1975

Base map constructed by
Virginia state office personnel

INSTALLATION COSTS – MONETARY

Estimated project costs for both land treatment and structural measures are shown in Table 1. Structural measure cost estimates are shown in greater detail in Table 2. Allocation between purposes and sharing of estimated costs between P.L. 566 and other than P.L. 566 funds are shown in Table 2A. Cost-sharing percentages for structural measures and for compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 shown in the Watershed Plan Agreement will be the basis for sharing actual costs incurred at the time of installation. These percentages are based upon the purposes involved, law, policy, and estimated costs.

LAND TREATMENT MEASURES

Estimated costs for land treatment measures, including technical assistance and installation costs shown in Table 1, are based on recent experiences in installation of similar measures. A comprehensive soil survey has been completed for the county. Technical assistance is required for resource inventories and evaluations and planning for installation of the needed conservation measures. Costs of technical assistance for the installation of forest land treatment measures are based on actual expenditures and accomplishments of the Virginia Division of Forestry. An analysis of costs against accomplishments was made for each measure to determine unit cost for technical assistance. Technical assistance, on lands undergoing development for other than agricultural uses, is designed to provide guidance to planning boards and individuals to minimize erosion, storm water runoff, and other problems.

The total estimated cost is \$4,899,260. Included are \$590,750 for installation of the land treatment measures, \$205,030 for technical assistance, and \$3,800 for forest fire control. The Virginia Division of Forestry in cooperation with the U.S. Forest Service will use \$7,350 of regular funds and services valued at \$8,600 through the going Cooperative Forest Management Program and \$42,300 in P.L. 566 funds for accelerated technical assistance. The Soil Conservation Service will provide \$42,580 from going program funds, the current level of technical assistance in this watershed. The Soil Conservation Service will also expend P.L. 566 funds in the amount of \$104,200 to accelerate technical assistance in the installation of planned land treatment measures and land use changes.

STRUCTURAL MEASURES

Costs of the structures consist of construction, engineering services, relocation, and landrights costs. Estimated costs for construction, engineering services, relocation, landrights, and project administration are based on recent experiences in the installation of similar measures under similar conditions. Project administration costs are estimated to be \$339,380.

Construction cost estimates are based on bid item schedules from preliminary designs and applicable unit prices from recent contract unit prices for similar work in Virginia. The construction cost is estimated to be \$2,547,580 which includes a 12 percent contingency allowance to cover unusual items or changed conditions at the time of construction. Public Law 566 construction cost is estimated to be \$2,186,689.

Construction costs for sites 1, 2, 5, and 7, single-purpose flood-water retarding structures, are estimated to be \$273,600, \$161,000, \$116,900, and \$224,500 respectively. The Soil Conservation Service, from P.L. 566 funds, will pay the construction costs for these structures.

The construction costs for structures 4 and 6, multiple-purpose structures for flood control and water supply storage for Fauquier County, are estimated to be \$536,820 and \$901,550 respectively. The local construction costs for these two structures are estimated to be \$241,122; including \$72,520 for features specifically for water supply, all of which will be paid by Fauquier County in order to incorporate 500 and 1,000 acre-feet, respectively, of municipal and industrial water supply storage in the structures, and to install raw-water intake systems for the specific purpose of water supply.

Construction costs for structure 3, a multiple-purpose structure for flood control and water supply storage for the town of Warrenton, are estimated to be \$333,210. The local construction costs for this structure are estimated at \$119,769, including \$26,410 for specific water supply features, all of which will be paid by the town of Warrenton in order to incorporate 500 acre-feet of municipal and industrial water supply storage in the structure and to install raw-water release features for the specific purpose of water supply.

Engineering services are estimated to cost \$159,370, which includes the usual costs for surveys, design, preparation of plans and specifications, and geologic investigations. Public Law 566 engineering services costs are estimated at \$134,754. Engineering services costs for Fauquier County are estimated at \$15,901, of which \$7,400 is for the raw-water intake structure and \$8,501 for participation in multiple-purpose structures 4 and 6. Engineering services costs for the town of Warrenton are estimated at \$8,715, of which \$3,000 is for the raw-water intake structure and \$5,715 for participation in multiple-purpose structure number 3.

Landrights costs were estimated by the sponsors' landrights committee and include those fee simple titles and flowage easements necessary for the permanent pool and floodwater areas, emergency spillways, dams (including construction zone), and public access to structures 4 and 6.

The county will secure fee simple title to sufficient land to provide for: the water supply pools, the dams and spillways, and access to the water supply pools of structures 4 and 6 at all stages. Landrights for the construction of structures 1, 2, 5, and 7 will be secured by Fauquier County. The town of Warrenton has secured all landrights necessary for construction of multiple-purpose structure 3. The area required for dams, emergency spillways, sediment pools, and water supply pools totals approximately 596 acres for the 7 dams. Flowage easements will be obtained on a total of 825 acres located between the sediment or water supply pool and the design high water elevations. The total cost of landrights was estimated by the sponsors' landrights committee at \$1,040,350.

Relocation costs will be shared by the Soil Conservation Service and the county on the basis of the total project costs less the relocation costs. Sharing of relocation costs shown in this plan amount to 43.3 percent sponsors' cost and 56.7 percent Soil Conservation Service cost. For the multiple-purpose structures, relocation costs were considered as joint costs and allocated to the purposes served. Relocation costs for this project were estimated by the sponsors' committee at \$13,000.

Project administration costs include the cost of contract administration, review of engineering plans prepared by others, Government representatives, inspection service during construction, relocation assistance advisory services, clerical and other miscellaneous expenses. These costs to the sponsors and the Soil Conservation Service are estimated to be \$35,100 and \$304,280, respectively. The sponsors' estimated project administration costs include contract administration, inspection services, relocation assistance advisory services and clerical and other administrative services they provide. Relocation assistance advisory services costs are estimated to be \$1,000. The town of Warrenton and Fauquier County will provide these services and bear the costs incurred without P.L. 566 cost sharing assistance. The Soil Conservation Service will assist the sponsors in providing other services and bear the cost incurred.

The joint construction, engineering, landrights, and relocation costs for the multiple-purpose structures were allocated between the purposes of flood prevention and municipal and industrial water supply on the basis of storage capacity provided for each purpose. The construction and engineering costs for water supply features are for the specific purpose of water supply. On this basis 89.50 percent of the joint costs of structure number 4 were allocated to flood prevention and 10.50 percent to municipal and industrial water supply. Similarly, 86.58 percent of the joint costs of structure number 6 were allocated to flood prevention, and 13.42 percent to municipal and industrial water supply. Fauquier County will provide all landrights acquisition funds for structures 4 and 6. The Soil Conservation Service will bear 89.50 percent of the joint construction

costs and the county 10.50 percent for structure number 4. The Soil Conservation Service will bear 86.58 percent of the joint construction cost for structure 6 and the county 13.42 percent of these costs. Fauquier County will pay 100 percent of the construction costs associated with the specific features for water supply in these structures. On the basis of storage capacity, 69.57 percent of the joint costs of structure number 3 are for flood prevention and 30.43 percent for municipal and industrial water supply. The Soil Conservation Service will bear 69.57 percent of the joint construction cost of this structure and the town of Warrenton will pay 30.43 percent of these costs. The town will pay 100 percent of the construction costs associated with the water supply features of this site. Landrights necessary for construction of this site have been secured by the town of Warrenton.

Fauquier County intends to request that the Soil Conservation Service prepare the design, layout and specifications for multiple-purpose structures 4 and 6. The county will pay 100 percent of the engineering costs associated with the water-supply raw-water intake features for each structure; 10.50 percent of the engineering costs associated with joint construction items in structure number 4; and 13.42 percent of the engineering costs associated with the joint construction items for structure number 6.

Engineering services for structure number 3, covering both joint and specific cost items, will be provided through an architects and engineers contract secured by the Soil Conservation Service. The town of Warrenton will pay 100 percent of the engineering costs associated with the municipal raw-water features and 30.43 percent of the engineering services costs associated with the joint construction items. The Soil Conservation Service will pay 69.57 percent of the costs associated with joint construction items for structure number 3.

Structures 1, 2, 5, and 7 are for single-purpose flood prevention. The Soil Conservation Service, from P.L. 566 funds, will provide the necessary engineering services for the installation of these structures.

The sponsors have established an 8-year project installation period for this project. The estimated obligation of project funds, including land treatment and structural measures, for each fiscal year during the installation period is as follows:

Year	P.L. 566 Funds		Other Funds		Total
	Structural	Land	Structural	Land	
	Measures	Treatment	Measures	Treatment	
	\$	\$	\$	\$	\$
1	42,765	18,300	318,430	81,635	461,130
2	762,614	18,325	207,246	81,635	1,069,820
3	315,695	18,300	433,035	81,635	848,665
4	807,739	18,325	356,881	81,635	1,264,580
5	79,525	18,300	137,800	81,635	317,260
6	447,505	18,325	3,510	81,635	550,975
7	132,100	18,300	1,755	81,635	233,790
8	45,151	18,325	7,929	81,635	153,040
Total	2,633,094	146,500	1,466,586	653,080	4,899,260

BENEFITS – MONETARY

The average annual value of benefits from structural measures is estimated to be \$433,470. The average annual floodwater damage reduction benefits will be \$86,345. Tables 5 and 6 give details of the project benefits.

Floodwater damage to crops and pasture will be reduced \$7,125. Other agricultural benefits will amount to \$38,870 and result from reduction of damages to farm roads, fences, ponds, and other similar improvements. Reduction of damages to highways and bridges will amount to \$5,025 annually.

Indirect benefits will amount to \$14,860 annually. These will result from reduction of power failures, late feed deliveries, delayed marketing, loss of work, interrupted public services, expenses of detouring traffic, and other such losses associated with floodwater, sediment, and erosion damages.

Flood protection provided by this project will make it possible for landowners to use their flood plain and some adjacent lands more effectively and intensively. Farm operators will have more freedom in selecting proper soil type and slope conditions for their various crops. Benefits from changes in cropping patterns on agricultural flood plain will amount to \$27,440 annually, and are listed as changed land use benefits in Table 6. Improved use of fertilizer, improved crop varieties, and other modern management practices will allow more efficient and more economical operations. Benefits from more intensive use of agricultural land have been estimated at \$83,535 annually, after allowing for the associated costs of development and production.

Damage reduction benefits to commercial properties, utilities, places of historic interest, and rural buildings are estimated to be \$11,750. From information provided by consultants retained by Fauquier County, and town of Warrenton, benefits to municipal water storage will amount to \$158,200 annually, based on alternative development costs.

Local secondary benefits resulting from the project are estimated to total \$42,950 annually. Of these benefits, \$34,730 annually are considered induced by the project and will result from increased local income and other returns to local suppliers from expenditures directly associated with the production and marketing of agricultural products. Other local secondary benefits stemming from the project will result from greater use of transportation, processing, and marketing facilities. Local economic development due to the expansion of the municipal water system and increased use of the area's utilities and service will increase both agricultural and general business activities. These

benefits will amount to \$8,220 annually. Fauquier County plans to develop non-project facilities at structures 4 and 6 which will allow incidental recreational use of these reservoirs for fishing. Based on use currently being experienced at comparable structures which have been developed in a similar manner, it is estimated that these lakes will provide 20,000 annual user visits, with an average value of \$2.50 per visit. After providing for an average operation and maintenance and replacement cost of 75 cents per user day, net incidental benefits to these structures amount to \$35,000 annually.

Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation of this project.

COMPARISON OF BENEFITS AND COSTS

Average annual installation cost of structural measures is estimated at \$251,176. Annual primary net benefits from planned structural measures, not including local secondary benefits, are estimated at \$390,520, giving a benefit-cost ratio of 1.6 to 1.0. Inclusion of local secondary benefits increases the estimated average annual benefits to \$433,470, producing a benefit-cost ratio of 1.7 to 1.0. Table 6 summarizes the annual benefits and costs.

INSTALLATION PROVISIONS

The John Marshall Soil and Water Conservation District, the Fauquier County Board of Supervisors, and the town of Warrenton are the sponsoring local organizations and will be responsible for the successful application of this plan. Their responsibilities will be established by memoranda of understanding and cooperative agreements with other agencies, individuals, and organizations.

An installation period of 8 years has been established for this project. Land treatment measures will be installed more or less uniformly over the entire project installation period. It is anticipated that structure number 4 will be installed first, followed by numbers 7, 3, 6, 1, 2, and 5 in that order. It is the sponsors' desire to complete all structures by early in the eighth year in order to complete all project administrative activities by the end of the project installation period.

LAND TREATMENT MEASURES

The John Marshall Soil and Water Conservation District will coordinate installation of the land treatment measures. This responsibility will be defined in memoranda of understanding and cooperative agreements with other agencies, organizations, and individuals.

Landowners and operators will be encouraged to apply and maintain the needed measures and treatment recommended for their lands. The Soil Conservation Service will provide technical assistance to landowners and operators in the planning and application of needed measures and land use changes; this will be especially important for land undergoing change from agricultural to urban uses. The forest land treatment measures will be installed by the landowners with technical assistance from the Virginia Division of Forestry in cooperation with the U.S. Forest Service.

STRUCTURAL MEASURES

The structural measures in this plan consist of four floodwater retarding structures and three multiple-purpose structures containing additional storage for municipal and industrial water supply. The town of Warrenton has secured the necessary landrights of multiple-purpose site 3. Fauquier County will secure the necessary landrights on the other six sites. Both of these sponsors have the right of eminent domain and agree to use this right if necessary to secure all landrights.

Investigation by the sponsors has revealed that one family will be displaced by the installation of this project. The town of Warrenton

and the county of Fauquier will meet all applicable requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 in securing the landrights. They will provide, without P.L. 566 financial assistance, such relocation assistance advisory services as may be needed, and will cost-share relocation payments in accordance with percentages shown in the Watershed Plan Agreement. An appraisal of the fair market value of the real property to be acquired will be made by a qualified land appraiser prior to negotiation of a purchase contract.

Fauquier County will provide written notice of displacement to the family involved, assist in filing the application for assistance, review and take action on the application for relocation assistance, review and process any grievance that may arise in connection with the displacement, and make relocation payments. The Soil Conservation Service will assist the county in fulfilling these responsibilities as a part of project administration.

The involved sponsor has determined that decent, safe, and sanitary replacement housing will be available for the family being displaced by the project and that they will be given notice to vacate at least 90 days before they have to move.

Fauquier County will install, operate, and maintain the recreation facilities at structures 4 and 6, and will provide public access to the sites. The county will purchase 18 acres on the east side of the reservoir near site 4, and 10 acres on the north side of the reservoir near site 6, for this purpose. The construction roads from Highway No. 602, which is near both of the sites, will be retained by the county and used for public access to the recreation areas.

The recreational, fish and wildlife, and other beneficial use potentials were evaluated for sites 1, 2, 3, 5, and 7. The results of these studies were reviewed with the sponsors, and with the appropriate state and federal agencies. The sponsors decided not to develop any of these sites for recreational use after careful consideration of potentials and resources. The general public will be prohibited from using these sites by cooperative agreements between Fauquier County, the town of Warrenton, and the affected landowners. Furthermore, a permit will not be granted by either the county or town, for development by other interests, unless facilities which meet all health and sanitary requirements by state and local government are provided.

The Soil Conservation Service will negotiate, as a part of its project administration services, A&E contracts with consultants acceptable to both the town of Warrenton and the Soil Conservation Service for surveys, investigations, design, and preparation of plans and specifications for structure No. 3. The Soil Conservation Service

will also let and administer contracts for this structure. Fauquier County intends to request that the Soil Conservation Service let and administer contracts and provide technical services for structures 1, 2, 4, 5, 6, and 7.

The Soil Conservation Service will, at P.L. 566 cost, provide construction inspection for all items on which P.L. 566 funds are spent. The Soil Conservation Service will also inspect other items of work where failure to operate as planned could adversely affect the stability or functioning of these cost-shared items.

Fauquier County will provide inspection services deemed necessary to assure that the water supply features for structures 4 and 6 will meet contract requirements and function properly. The town of Warrenton will provide similar services for structure No. 3. The sponsors' project administration services includes the responsibility for providing, without P.L. 566 cost-sharing assistance, construction inspection necessary to assure that the project installation conforms with contract requirements.

The sponsors have presented satisfactory assurances that at least 50 percent of the farm land above the retention reservoirs will be under conservation agreements before construction is initiated.

OPERATION AND MAINTENANCE PROVISIONS

Land treatment measures will be operated and maintained by landowners and operators through cooperative agreements with the John Marshall Soil and Water Conservation District.

Fauquier County will operate and maintain the four floodwater retarding structures (Nos. 1, 2, 5, and 7) at an estimated annual cost of \$1,000 each, and of the two multiple-purpose structures (Nos. 4 and 6) at an estimated annual cost of \$2,000 each. The town of Warrenton will operate and maintain the other multiple-purpose structure (No. 3) at an estimated annual cost of \$1,500. Structure No. 3 will be operated to insure that changes in dissolved oxygen and temperature do not adversely affect downstream aquatic systems.

The Virginia Commission of Game and Inland Fisheries will stock two of the multiple-purpose structures (Nos. 4 and 6) with fish. Fauquier County will provide public access to the sites. Resources and facilities provided for public fishing at these two sites will be operated, maintained and replaced as necessary by the county. The county will also operate and maintain modern sanitary facilities as required by state and local health laws and regulations to allow full use of the municipal water supply pools for fishing and other incidental recreation. In addition, the county will repair and replace recreation equipment and facilities when needed. The county will seek assistance from the Virginia Commission of Game and Inland Fisheries in maintaining the fishery and to improve, protect, and preserve wildlife resources of the lakes and surrounding park lands. Funds for operation and maintenance of the fishery resources and facilities provided for public recreation will be obtained from user fees, not to exceed that amount required to defray operation and maintenance costs and to recover the county's initial investment.

Typical operation items will include the operation of gates for water supply and flow management, the removal of trash and debris from the pools and structures after floods, the development and enforcement of regulations for use of recreational facilities, the restriction of motor vehicles to designated roads and parking areas, the prevention of pollution to water used for public consumption and/or recreation, the timely disposal of garbage and other refuse, and the elimination of safety hazards.

Typical vegetative maintenance items will include mowing, fertilizing, reseeding, weed control, and grazing control for vegetated areas. Maintenance of the earth dams may include replacement and revegetation of eroded areas in the vegetated spillways or on the dams, inspection and clean-out of drainage systems, and replacement of rock riprap as needed. Maintenance of appurtenant structures may include removal of debris from the trash racks and impact basins, maintenance of gates and valves, repainting of all surfaces requiring protection by paint, maintenance of recreational features, and repairing or replacing of signs as needed.

Designated representatives of the Soil Conservation Service and the sponsors will jointly make an inspection annually, after severe floods, and after the occurrence of any other unusual conditions that might adversely affect the structures. These inspections will continue for 3 years following installation of the dams. Inspections after the third year will be made by the sponsors. They will prepare a report, and furnish a copy to the Service employee responsible for the inspection follow-up activities. These reports will be thoroughly reviewed by the Service representative. Any evidence of needed inspections, or maintenance not being performed properly, will be reported immediately and appropriate action taken by the responsible sponsors.

A specific operation and maintenance agreement will be executed prior to signing a landrights, relocation, or project agreement. The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with P.L. 566 financial assistance. The operation and maintenance agreement will contain a reference to the Virginia Operation and Maintenance Handbook and an operation and maintenance plan will be prepared for each structural measure.

FINANCING PROJECT

The estimated \$590,750 cost for application of land treatment will be borne by the landowners and operators with the cost-sharing assistance available under established conservation programs. Cooperative forest fire protection, estimated to cost \$3,800 will continue to be financed through existing conservation programs.

Technical assistance now available through going conservation programs will be continued at about the same rate that existed prior to the development of this plan. The Soil Conservation Service will use \$42,580 from regular program funds, and the Virginia Division of Forestry will use \$7,350 of regular funds and services valued at \$8,600 through the Cooperative Forest Management Program. The costs for accelerated technical assistance will be financed from P.L. 566 funds. Of these funds, the U.S. Forest Service will use \$42,300 in cooperation with the Virginia Division of Forestry. The Soil Conservation Service will use \$104,200.

The town of Warrenton will provide the nonfederal share of project costs for structure number 3, estimated at \$233,584. This includes landrights valued at \$105,100, and the costs for municipal water supply storage and any relocation assistance advisory services and relocation costs. The necessary landrights for this structure have been secured, subject to approval of this project plan. Fauquier County will provide the nonfederal share of the project costs for all other structural measures, estimated at \$1,197,902. This includes landrights valued at \$935,250; the costs for municipal water supply storage in structures 4 and 6; and relocation, and relocation assistance advisory services costs required for project installations.

The town of Warrenton and Fauquier County have analyzed the installation schedule and their financial needs. Each sponsor has determined that sufficient general revenue funds will be available at the time and in the amounts required to meet their needs associated with the installation of this project.

This plan does not constitute a financial document to serve as a basis for obligation of federal funds. Financial or other assistance to be furnished by the Soil Conservation Service, Forest Service, or the Virginia Division of Forestry in carrying out this watershed plan is contingent upon appropriation of funds for this purpose.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Cedar Run Watershed, Virginia

Installation Cost Item	Unit	Land	Number	Estimated Cost (Dollars) 1/									
				P. L. 566 Funds		Other		Land		Non-Federal Land		Land	
				: Fed.	: Non-Fed.	: Fed.	: Non-Fed.	: SCS	: FS	: SCS	: FS	: SCS	: FS
				4/	4/	4/	4/	4/	4/	4/	4/	4/	4/
				Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
LAND TREATMENT													
Land Areas 3/													
Cropland			4,550	4,550				95,900		95,900		95,900	
Grassland			8,200	8,200				300,200		300,200		300,200	
Forest Land			9,776	9,776				72,750		72,750		72,750	
Other Land			420	420				121,900		121,900		121,900	
Coop. Forest Fire Control			23,178	23,178				3,800		3,800		3,800	
Technical Assistance								42,580		42,580		42,580	
								15,950		15,950		15,950	
TOTAL LAND TREATMENT								560,580		560,580		560,580	
STRUCTURAL MEASURES													
Construction													
Floodwater Retarding Struc. No.			4	4				776,000		776,000		776,000	
Multiple-Purpose Struc.								213,441		213,441		213,441	
No. 3								93,359		93,359		93,359	
Water Supply Features								26,410		26,410		26,410	
Multiple-Purpose Struc.								52,841		52,841		52,841	
No. 4								33,570		33,570		33,570	
Water Supply Features								115,761		115,761		115,761	
Multiple-Purpose Struc.								38,950		38,950		38,950	
No. 6								360,891		360,891		360,891	
Water Supply Features								134,754		134,754		134,754	
Subtotal - Construction								2,186,689		2,186,689		2,186,689	
Engineering Services													
Relocation Payments								7,371		7,371		7,371	
Project Administration													
Construction Inspection								135,510		135,510		135,510	
Other								168,770		168,770		168,770	
Advisory Services								1,000		1,000		1,000	
Subtotal - Administration								304,280		304,280		304,280	
Other Costs													
Land Rights								1,040,350		1,040,350		1,040,350	
Subtotal - Other								1,040,350		1,040,350		1,040,350	
TOTAL STRUCTURAL MEASURES								2,633,094		2,633,094		2,633,094	
TOTAL PROJECT								2,737,294		2,737,294		2,737,294	

1/ Price Base: 1974

2/ Includes \$8,600 provided through coop. forest management.

3/ Includes only areas estimated to be adequately treated or protected during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just adequately treated areas.

4/ Federal agency responsible for assisting in installation of works of improvement.

Date: December 1975

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
 (at time of Work Plan Preparation)
 Cedar Run Watershed, Virginia

Measures	Unit	Applied to Date	Total Cost (Dollars) ^{1/}
<u>Land Treatment</u>			
Brush Management	acres	815	6,113
Conservation Cropping System	acres	10,025	67,669
Contour Farming	acres	7,375	49,781
Drain	feet	115,000	97,750
Drainage Field Ditch	feet	85,500	41,040
Field Border	feet	7,750	1,550
Grassed Waterway or Outlet	acres	47	12,925
Pasture and Hayland Management	acres	12,300	70,725
Pasture and Hayland Planting	acres	16,400	1,148,000
Pond	no.	165	247,500
Stripcropping	acres	375	5,625
Wildlife Upland Habitat Mgt.	acres	535	24,075
Spring Development	no.	12	10,800
Pipeline for Water Supply	feet	2,400	4,200
Trough or Tank	no.	475	106,875
Minimum Tillage	acres	12,800	25,600
Crop-Residue Management	acres	9,200	43,700
Tree Planting	acres	64	1,920
Hydrologic Cultural Oper.	acres	3,000	4,800
Woodland Grazing Control	acres	108	200
<hr/>			
TOTAL	xxx	xxx	1,970,848

^{1/} Price Base: 1974

Date: December 1975

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Cedar Run Watershed, Virginia
(Dollars) 1/

Item	Installation Cost PL-566 Funds :			Installation Cost - Other Funds :			Total
	Construc- tion :	Engi- neering :	Relocation : Payments :	Construc- tion :	Engi- neering :	Relocation : Payments :	
Floodwater Retarding Structures:							
No. 1	273,600	16,745	290,345			136,575	426,920
No. 2	161,000	17,180	178,180			58,575	236,755
No. 5	116,900	12,475	129,375			132,175	261,550
No. 7	224,500	13,740	238,240			102,925	341,165
Multiple-Purpose Structures:							
No. 3	213,441	13,065	226,506			105,100	430,680
Water Supply Features							
No. 4	450,409	27,566	477,975			213,750	747,800
Water Supply Features							
No. 6	746,839	33,983	7,371			291,250	1,206,100
Water Supply Features							
						5,629	42,950
Subtotal	2,186,689	134,754	7,371	2,328,814	360,891	1,040,350	3,760,300
Project Administration	xxx	xxx	xxx	304,280	xxx	xxx	35,100
GRAND TOTAL	2,186,689	134,754 ^{2/}	7,371 ^{4/}	2,633,094	360,891	1,040,350 ^{3/}	4,099,680

1/ Price Base: 1974

2/ Engineering contract costs to be borne \$38,580 by PL-566 funds and \$17,680 by other funds.

3/ Includes \$1,600 for survey, legal fees and other costs.

4/ Relocation payments will be shared as provided in P.L. 91-646 and in paragraph numbered 2 of the Watershed Plan Agreement.

Date: December 1975

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY
Cedar Run Watershed, Virginia
(Dollars) 1/

Item	COST ALLOCATION			COST SHARING				
	:			:				
	Purpose			P.L. - 566			Other	
	Municipal			Municipal			Municipal	
	Flood			Flood			Flood	
	Prev.	Storage	Total	Prev.	Storage	Total	Prev.	Storage
Floodwater Retarding Structures 1, 2, 5, and 7	1,266,390		1,266,390	836,140		836,140	430,250	
Multiple-Purpose Structure No. 3	299,624	131,056	430,680	226,506		226,506	131,056	204,174
Water Supply Features		29,410	29,410				29,410	29,410
Multiple-Purpose Structure No. 4	669,281	78,519	747,800	477,975		477,975	78,519	269,825
Water Supply Features		36,970	36,970				36,970	36,970
Multiple-Purpose Structure No. 6	1,044,241	161,859	1,206,100	787,204	989	788,193	160,870	417,907
Water Supply Features		42,950	42,950				42,950	42,950
GRAND TOTAL	3,279,536	480,764	3,760,300	2,327,825	989	2,328,814	951,711	1,431,486

1/ Price Base: 1974

2/ Public Law 83-566 share of municipal water supply cost is for that portion of the relocation payments allocated to water supply.

Date: December 1975

TABLE 3 - STRUCTURAL DATA
STRUCTURES WITH PLANNED STORAGE CAPACITY

Cedar Run Watershed, Virginia

ITEM	UNIT	Structure Number										TOTAL	
		1	2	3	4	5	6	7	:	:	:		
Class of Structure	Sq. Mi.	9.68	2.48	c	c	16.03	c	3.35	c	32.36	c	6.95	xxx xx
Drainage Area (Total)	Sq. Mi.	-	-	-	-	-	-	-	-	10.48	-	-	63.90
Controlled													xxxxxx
Curve No. (1-day) (AMC II)		75.0	70.0	75.0	71.0	71.0	78.0	78.0	76.0	76.0	76.0	76.0	xxxxxx
Elevation Top of Dam	Ft.	354.4	335.6	507.4	324.9	324.9	290.9	290.9	362.2	362.2	417.9	417.9	xxxxxx
Elevation Crest Emergency Spillway	Ft.	344.8	329.1	500.0	313.9	313.9	284.6	284.6	350.0	350.0	407.7	407.7	xxxxxx
Elevation Crest Principal Spillway	Ft.	322.5	317.4	488.3	290.7	290.7	275.2	275.2	325.0	325.0	383.4	383.4	xxxxxx
Maximum Height of Dam	Ft.	61.3	42.3	53.0	61.7	61.7	28.8	28.8	74.2	74.2	60.1	60.1	xxxxxx
Volume of Fill	Cu. Yds.	206,900	84,300	261,600	460,500	460,500	56,300	56,300	397,600	397,600	173,900	173,900	1,641,100
Total Capacity 1/	Ac. Ft.	3,128	702	1,643	4,760	4,760	1,122	1,122	7,451	7,451	2,115	2,115	20,921
Sediment Submerged	Ac. Ft.	753	220	286	626	626	196	196	1,105	1,105	346	346	3,532
Sediment Aerated	Ac. Ft.	42	12	11	35	35	11	11	61	61	19	19	191
Beneficial Use (W.S.)	Ac. Ft.	-	-	500	500	500	-	-	1,000	1,000	-	-	2,000
Retarding	Ac. Ft.	2,333	470	846	3,599	3,599	915	915	5,285	5,285	1,750	1,750	15,198
Surface Area													xxxxxx
Sediment pool 2/	Acres	65	24	(34)	(81)	(81)	52	52	(98)	(98)	39	39	393
Beneficial use pool (W.S.)	Acres	-	-	58	109	109	-	-	139	139	-	-	306
Retarding pool 1/	Acres	152	64	92	227	227	166	166	330	330	127	127	1,158
Principal Spillway Design													xxxxxx
Rainfall Volume (areal)(1 day)	In.	8.0	8.0	8.0	7.81	7.81	8.0	8.0	7.74	7.74	8.0	8.0	xxxxxx
Rainfall Volume (areal) (10 day)	In.	13.7	13.7	13.7	13.56	13.56	13.7	13.7	13.49	13.49	13.7	13.7	xxxxxx
Runoff Volume (10 day)	In.	7.73	6.66	7.73	6.75	6.75	8.39	8.39	7.76	7.76	7.95	7.95	xxxxxx
Capacity of Principal Spillway (Max.)	cfs	274	113	125	371	371	96	96	1,048	1,048	192	192	xxxxxx
Frequency of operation - Emer. Spillway	% chance	1	1	1	1	1	1	1	1	1	1	1	xxxxxx
Dimensions of Conduit	In.	42	30	30	48	48	30	30	2 @ 54	2 @ 54	36	36	xxxxxx
Emergency Spillway Design													xxxxxx
Rainfall Volume (ESH) (areal)	In.	11.1	11.1	11.1	10.77	10.77	11.1	11.1	10.10	10.10	11.1	11.1	xxxxxx
Runoff Volume (ESH)	In.	7.91	7.22	7.91	7.05	7.05	8.33	8.33	7.10	7.10	8.04	8.04	xxxxxx
Storm Duration	Hrs.	6	6	6	6	6	6	6	6	6	6	6	xxxxxx
Type		Veg.	Veg.	Veg.	Rock	Rock	Veg.	Veg.	Rock	Rock	Veg.	Veg.	xxxxxx
Bottom Width	Ft.	300	200	250	400	400	200	200	500	500	250	250	xxxxxx
Velocity of flow (V _e)	Ft./Sec.	8.9	7.0	7.1	8.7	8.7	6.4	6.4	8.9	8.9	9.0	9.0	xxxxxx
Slope of exit channel	Ft./Ft.	0.025	0.029	0.029	0.0255	0.0255	0.031	0.031	0.025	0.025	0.025	0.025	xxxxxx
Max. reservoir water surface elevation	Ft.	348.3	331.4	502.4	317.6	317.6	286.6	286.6	353.8	353.8	411.2	411.2	xxxxxx
Freeboard Design													xxxxxx
Rainfall Volume (FH) (areal) (6 hrs.)	In.	27.3	27.3	27.3	26.48	26.48	27.3	27.3	24.84	24.84	27.3	27.3	xxxxxx
Runoff Volume (FH)	In.	23.66	22.75	23.66	22.14	22.14	24.18	24.18	21.40	21.40	23.84	23.84	xxxxxx
Storm Duration	Hrs.	6	6	6	6	6	6	6	6	6	6	6	xxxxxx
Max. reservoir water surface elevation	Ft.	354.4	335.6	507.4	324.9	324.9	290.9	290.9	362.2	362.2	417.9	417.9	xxxxxx
Capacity Equivalents													xxxxxx
Sediment Volume	In.	1.54	1.76	1.58	0.77	0.77	1.15	1.15	1.00	1.00	0.99	0.99	xxxxxx
Retarding Volume	In.	4.52	3.56	4.49	4.21	4.21	5.12	5.12	4.53	4.53	4.72	4.72	xxxxxx
Beneficial Volume	In.	-	-	2.65	0.58	0.58	-	-	0.86	0.86	-	-	xxxxxx
1/ Crest of Emergency Spillway.													xxxxxx
2/ Figures in () indicate sediment pool only for structures containing beneficial storage.													xxxxxx

1-32

Date December 1975

1/ Crest of Emergency Spillway.

2/ Figures in () indicate sediment pool only for structures containing beneficial storage.

Date December 1975

TABLE 4 - ANNUAL COST

Cedar Run Watershed, Virginia

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost	Total
All Structural Measures	221,670	9,500	231,170
Project Administration	20,006	20,006
GRAND TOTAL	241,676	9,500	251,176

1/ Price Base: 1974.2/ 100 years @5-7/8 percent interest.Date December 1975

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCATION BENEFITS

Cedar Run Watershed, Virginia

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crops and Pasture	13,450	6,325	7,125
Other Agricultural	64,940	26,070	38,870
Roads and Bridges	8,690	3,665	5,025
Commercial Property, Utilities and Rural Buildings	15,440	3,690	11,750
Sub total	102,520	39,750	62,770
Reservoir Sedimentation	16,880	1,540	15,340
Indirect	22,495	7,635	14,860
Total	141,895	48,925	92,970

1/ Price Base - 1974 Agricultural values, current normalized prices; all other values current prices (1974).

Date December 1975

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Cedar Run Watershed, Virginia

(Dollars)

Evaluation Unit:	AVERAGE ANNUAL BENEFITS 1/					:	
	More Intensive Land Use Agr.	Changed Land Use Agr.	Muni- cipal Water Supply	Incidental Recreation	Local Secondary	Total	3/
All Structural Measures	86,345	83,535	27,440	158,200	35,000	42,950	433,470
							231,170
							1.9:1.0
Project Administration							20,006
GRAND TOTAL	86,345	83,535	27,440	158,200	35,000	42,950	433,470
							251,176
							1.7:1.0

1/ Price Base: 1974 - Agricultural values, Current Normalized Prices; all other values current prices (1974)

2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$6,625 annually.

3/ From Table 4.

Date: December 1975

TABLE 7 - CONSTRUCTION UNITS

Cedar Run Watershed, Virginia

(Dollars) 1/

<u>Measures in</u> <u>Construction Unit 2/</u>	<u>Annual</u> <u>Benefit</u>	<u>Annual</u> <u>Cost</u>
Dams 3, 6, and 7	154,255	135,580
Dam 4	110,195	48,713

1/ Price Base 1974- Agricultural values, current normalized prices; all other values current prices (1974).

2/ All other structural measures were evaluated as part of the total project, and not divided into construction units.

Date: December 1975

PRINCIPLES AND STANDARDS PHASE-IN ADDENDUM

CEDAR RUN WATERSHED PLAN

FAUQUIER COUNTY, VIRGINIA

INTRODUCTION

This addendum was developed in accordance with phase-in procedures adopted by the Water Resources Council for level C studies for which field studies, analyses, and evaluations were completed as of October 25, 1973, and which were formulated in accordance with Senate Document 97 as supplemented and amended.

DISCOUNT RATE COMPARISON

The selected plan was formulated and evaluated using an interest rate of 5-7/8 percent, 1974 current normalized prices for agricultural values, and current 1974 prices for all other values. Incidental recreation benefits are based upon values outlined in Senate Document 97. Annual project costs are \$251,176; benefits, excluding local secondary benefits are estimated to be \$390,520 giving a benefit-cost ratio of 1.6 to 1.0. Inclusion of local secondary benefits increases the annual benefits to \$433,470 and the benefit-cost ratio to 1.7 to 1.0.

Using an interest rate of 6-1/8 percent, annual project costs are \$251,760; benefits, excluding local secondary benefits are estimated at \$417,650, giving a benefit-cost ratio of 1.7 to 1.0. Inclusion of local secondary benefits increases the annual benefits to \$432,360, and the benefit-cost ratio to 1.7 to 1.0.

ABBREVIATED ENVIRONMENTAL QUALITY PLAN

ENVIRONMENTAL CONCERNS

The major environmental concerns within the watershed are related to floodwater damages, erosion and sediment problems, preserving and enhancing fish and wildlife values, the maintenance of open space in urbanizing areas for future recreational needs, uncontrolled urban development, and protection of any geological, historical, or archeological finds.

Cedar Run Watershed Project area, containing 65,517 acres, is located in Fauquier County, Virginia. The flow, generally southeasterly in direction, drains into Prince William County where Cedar Run and Broad Run unite to form Occoquan Creek, which is a part of the Potomac River drainage basin. Topography of the watershed ranges from gently rolling to hilly and is typical of the northern Piedmont physiographic province. Elevations range from about 1,340 feet above mean sea level along the headwater ridges to 180 feet in the channel at the Fauquier-Prince William County line. Land in the flood plain is quite flat when viewed perpendicular to the stream channel and often rises sharply at the intersection of the flood plain and the toe of the hillsides.

Part of the town of Warrenton, county seat of Fauquier County, is located in the northwestern area of the watershed. The communities of Catlett and Calverton, even though not incorporated as towns, serve as community centers for the lower part of the watershed. The major portion of the highway system in the watershed is not in the valleys; however, the roads and bridges which cross the valleys and streams are subject to flooding. Other groups of homes have developed in recent years primarily adjacent to the highways. Many of the watershed residents travel out of the area each day for employment. The forest, wildlife, and the esthetically pleasing countryside are highly valued by the residents and make it a pleasant place in which to live.

Individual farms within the watershed have varying percentages of land use; however, the predominate land use of the average and larger size farm consists of pastureland, cropland, and forest land. This presents a pleasant rural environment typified by low rolling hills covered with deciduous and mixed pine forests, interspersed by crops and pasture bordered by white board fences.

Agriculture is the principal industry in the project area, and there are many large farms and estates. Livestock, especially horses and cattle, and dairy products are the chief sources of farm income.

Types of cropping practices in past years caused high erosion rates resulting in decreased channel capacity and the subjection of flood plain land to frequent flooding. Farmers became discouraged and ceased using the flood plain land for cultivated crops. If the flood plains are given flood protection from the 2-year to 5-year storm, the fertile flood plain soils will be farmed more intensively with less of the erosive upland being used for cultivated crops. Although the erosion has been reduced in the watershed in recent years, there is a need for a further reduction before erosion is within acceptable levels.

With the continuing demand for saw logs and other wood products obtained from forests in the watershed, it is important that good management practices be used to prevent increased runoff, erosion, and serious deterioration of the natural environment. Assisting the landowner to understand the use of the best forestry methods not only helps to reduce these problems but also helps the landowners and the nation economically by providing a much needed commodity.

At present, Cedar Run provides little recreational fishing. There is a need for more open water in this vicinity to furnish fishing and other water based recreational opportunities for use by the public. This need will become more urgent in the future.

The County Planners desire that the county develop in an orderly way to improve its economic base; provide a more adequate local income for the residents; reduce the number of people who each day travel considerable distances outside of the watershed and county in order to find employment; reduce erosion and sedimentation; furnish recreational opportunities; encourage agricultural growth in locations which will be best suited for this purpose; and cause the least undesirable impact on the farms, forest land, wildlife, and esthetics of the area.

Flood plain zoning and erosion and sediment control are presently being administered in the watershed through Fauquier County ordinances. One of these ordinances prohibits building in the flood plain below the 100-year flood line, and allows only limited development in the

flood hazard area. Another ordinance has been implemented to control soil erosion, particularly erosion stemming from the site preparation on future developments.

Water in Occoquan Creek and its tributaries, including Cedar Run, above the Occoquan Reservoir, now operated by the Fairfax County Water Authority, is classified as III-B by the Virginia State Water Control Board. According to standards adopted in 1970 1/, the "III " is a major class designation "free flowing streams (coastal zone and Piedmont zone to the crest of the mountains)" and the "B" is a subclass for "Waters generally satisfactory for use as public or municipal water supply, primary contact recreation (prolonged intimate contact; considerable risk of ingestion), propagation of fish and other aquatic life, and other beneficial uses."

OBJECTIVES

The environmental objectives are to maintain and enhance the quality of the project area by: (1) protecting its natural beauty, (2) maintaining the quality and quantity of available water, (3) protecting the land by reducing erosion and sediment losses, (4) enhancing the wildlife habitat, and (5) protecting places of historical value and any archeological finds.

COORDINATION AND FORMULATION

Coordination

Meetings with the sponsors and discussions with other interested agencies, groups, and individuals provided the objectives to be considered and the input needed for formulation of this plan.

The Formulation Process

The various alternatives considered in the formulation process were: floodwater retarding structures; multiple-purpose structures; accelerated land treatment measures; flood plain acquisition with less intense uses; no project; and combinations of these alternatives.

Floodwater retarding structures would improve the environment by providing stream sediment control and flood protection downstream. It

1/ Virginia State Water Control Board, 1970, Commonwealth of Virginia Water Quality Standards.

would not meet the objective of enhancing wildlife habitat. It would instead permanently deprive wildlife of 393 acres of habitat; 289 acres of pastureland, 104 acres of forest land, and about 7 miles of perennial stream. Since each of these commitments means a loss of habitat, and, considering the aggravated conditions during project construction, it was agreed that this alternative would not be in the best interest of the natural environment.

Multiple-purpose structures presented in the selected plan would have essentially the same benefits as the single-purpose structures, with the additional provision of public water supply. The objective of maintaining quantity and quality of available water would be enhanced, but the over-all environment of this area will not benefit from public water supply. An additional 93 acres of pastureland and 0.7 mile of perennial stream would have to be committed, totaling 486 acres of natural habitat permanently lost. Also, the localized damage during construction and the potential impact of accelerated urban development upon the environment add to the undesirable impacts of this alternative.

The alternative of accelerated land treatment measures would contribute to reduced erosion and sediment, thereby improving water quality; would protect the natural beauty; would enhance wildlife habitat; and would improve hydrologic conditions, reducing runoff and flooding to a degree. There are 22,946 acres of cropland, pastureland, and forest land scheduled to receive accelerated land treatment measures as presented in the watershed plan, supplementing the existing 32,571 acres on which conservation practices have already been installed under the going program. This proposal met with the approval of all parties expressing an opinion, and was therefore adopted as the best alternative by which to implement an environmental quality plan.

Flood plain acquisition and less intensive use of flood plain lands was considered as an alternative. It would support the objectives adopted, and enhance the natural environment while reducing the flood hazard. This alternative would require the purchase of about 5,795 acres of flood plain land and associated improvements at an estimated cost of about \$7,000,000. It would have the combined effect of increasing the tax load, while reducing the real estate tax base. The county would also be faced with the problem of finding beneficial uses for the acquired acreage, which would be compatible with the associated flood hazard. Furthermore, the involved landowners objected to the loss of their properties, some of which would have to be condemned and acquired through eminent domain. For these reasons, it was decided that this alternative could not be effectively implemented, and therefore, should not be considered as a viable alternative.

No project was considered as an alternative. Much sentiment was received which favored leaving the environment alone and letting nature work out her own problems. However, a review of the stated objectives emphasized the need to manage, enhance, and protect various aspects of the natural environment. Therefore, the no project alternative was rejected.

Several suggestions were mentioned that involved combinations of alternative measures. None of the combinations discussed were felt to be the most effective environmentally. Therefore, this alternative was rejected.

THE ABBREVIATED ENVIRONMENTAL QUALITY PLAN

This plan incorporates accelerated land treatment measures only. The land treatment measures are identical with those proposed for the selected plan.

Much of the watershed land, through natural means and applied treatment, is now adequately protected to retard surface runoff and keep erosion to an acceptable minimum. Technical assistance, now available through the John Marshall Soil and Water Conservation District, Virginia Cooperative Extension Service and the Virginia Division of Forestry through cooperative programs with the U.S. Forest Service, with appropriate acceleration, would be needed to complete the plan. Each conservation and forest land plan would need to be reviewed, new plans developed in some cases, and necessary treatment planned. Assistance would be needed to apply this treatment and to maintain the adequate cover that is now on the ground. Technical assistance would also be needed to gather and interpret soils and other resource information.

The conservation district directors, community leaders, landowners, and representatives of state and federal agencies, agreed that essential land treatment should be applied to 4,550 acres of cropland, 8,200 acres of pastureland, 420 acres of other land, and 9,776 acres of forest land. Planned land treatment measures include 150 acres of wildlife upland habitat management.

Land treatment measures to be installed on 4,550 acres of cropland include contour farming, conservation cropping systems, diversions, grassed waterways, cover and green manure crops, minimum tillage and crop residue management.

Land treatment measures to be applied to 8,200 acres of pastureland include pasture management, pasture planting, brush management, fencing, and ponds.

Forest land treatment, with varying degrees of intensity, is planned on 9,776 acres. Fire prevention, and insect and disease control is planned for the total acreage. Other practices aimed at reducing erosion and improving hydrologic cover conditions would include tree planting, timber stand improvement, protection from grazing, seeding grass, and constructing water diversion bars on skid trails and roads.

The time required to install the accelerated land treatment measures would be 8 years.

Measures planned for 420 acres of other land and 150 acres of wild-life habitat improvement would be applied by the individual land-owners and/or operators.

Implementation

The costs for land treatment measures would be borne by landowners and operators. Cost-sharing assistance is available through existing conservation programs. Technical assistance would be furnished by local, state, and federal agencies through their going program funds, plus P.L. 566 funds for necessary acceleration of technical assistance. Each agency would bear the project administration costs it would incur during project installation.

Cost Distribution

<u>Cost Item</u>	<u>Cost (Dollars)</u>
Treatment of land areas	1,523,000
Technical assistance	411,700
Total	1,934,700

Effects and Impacts

Approximately 22,946 acres of watershed land would be affected by the application of accelerated conservation land treatment measures. Approximately 45 percent of the watershed has already benefited by application of conservation land treatment measures under the going program. More is expected to benefit during project installation. Both vegetative and structural types of land treatment measures will effectively reduce runoff, conserve soil moisture, prevent excessive loss of topsoil on 275 farms, and help control erosion on nonagricultural development.

Land treatment would help restore and maintain soil productivity by adding or holding plant nutrients. It would reduce soil losses on cropland and pastureland to tolerable limits of 4 tons or less per acre per year so that, in the future, a suitable soil profile

will be available to grow plants for a sustained and indefinite period. Soil losses on forest land would be reduced to less than 2 tons per acre per year. The county ordinance to control erosion and sediment requires developers to prepare site plans prior to construction which include land treatment measures to control erosion on their project site.

Land treatment measures would reduce runoff on an annual basis, as indicated from studies conducted by the Agricultural Research Service 1/, from 28 to 56 percent, depending upon the practices installed. Studies conducted by the Extension Division of Virginia Polytechnic Institute and State University 2/ show that no-tillage planting can result in 80 - 90 percent less runoff.

Where appropriate, land use changes would be made. Pollution of surface waters by pollutants attached to soil particles would be greatly reduced by reducing erosion.

Conservation land treatment would be installed on 4,550 acres of cropland, 8,200 acres of pastureland, 420 acres of other land, and 9,776 acres of forest land. Land treatment measures would include 150 acres of wildlife upland habitat management.

A resource management system is a group of interrelated conservation practices or land treatment measures and management techniques applied to a given resource such as cropland, forest land, or pastureland for specified functions or uses such as timber, forage, hay and crop production; improvement of fish and wildlife habitat; improvement of water quality; and improvement of esthetics in the watershed. See Appendix D. Many of the measures will enable landowners to more fully utilize sound resource management systems to increase efficiency and volume of production. It is estimated that accelerated land treatment measures would reduce the gross erosion rate from 5.8 to 3.5 tons per acre per year.

Land treatment measures would reduce the amount of sediment reaching the Warrenton reservoir by an estimated 162 tons, and would reduce the amount of sediment leaving the watershed by about 15,134 tons annually. The sediment from Cedar Run contributes to the total load in Occoquan Creek. Therefore, reducing the volume of sediment would lessen downstream damages to municipal and industrial water supplies, fish habitat, recreational areas, and esthetics. Soil surveys and other resource inventories and evaluations would provide basic information needed by landowners planning land use changes and improved resource management systems.

1/ Agricultural Research Service, Technical Bulletin 1281, USDA, Runoff and Erosion Control Studies on Cecil Soil in the Southern Piedmont.

2/ Virginia Polytechnic Institute and State University, Publication 419, No-Tillage Machinery and Seedbed Requirements.

DISPLAY ACCOUNTS FOR THE SELECTED PLAN

CEDAR RUN WATERSHED PROJECT

FAUQUIER COUNTY, VIRGINIA

Selected Plan
 Cedar Run Watershed Project, Fauquier County, Virginia
 NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measures of Effects</u> <u>1/</u>	<u>Components</u>	<u>Measures of Effects</u> <u>1/</u>
Beneficial effects:			
A. The value to users of increased outputs of goods and services		Adverse effects:	
1. Flood prevention	\$197,320	A. The value of resources required for a plan	
2. Municipal and Industrial water supply	158,200	1. Multiple-purpose and flood prevention reservoirs and appurtenances	
3. Incidental Recreation	35,000	Project Installation	\$221,670
		(Structural Measures)	
		Project Administration	20,006
		Operations, Maintenance & Replacement	9,500
Total beneficial effects	\$390,520	Total adverse effects	\$251,176
		Net beneficial effects	\$139,344

1/ Average annual values



Selected Plan
Cedar Run Watershed Project, Fauquier County, Virginia
REGIONAL DEVELOPMENT ACCOUNT

<u>Components</u>		<u>Measure of effects</u> ^{1/}		<u>Components</u>	<u>Measures of effects</u> ^{1/}	
		<u>Regional</u>			<u>Regional</u>	<u>Rest of Nation</u>
A. Income:				A. Income:		
Beneficial effects:				Adverse effects:		
1. The value of increased output of goods and services to users residing in the region				1. The value of resources contributed from within the region to achieve the outputs		
a. Flood Prevention		\$197,320	-	a. Multiple-purpose and flood prevention reservoirs and associated facilities		
b. Municipal and Industrial water supply		158,200		Project Installation (Structural Measures)	\$84,386	\$137,284
c. Secondary		42,950		Project Administration	2,069	17,937
d. Incidental Recreation		35,000		Operations, Maintenance & Replacement	9,500	
Total beneficial effects		\$433,470	-	Total Adverse effects	\$95,955	\$155,221
				Net beneficial effects	\$337,515	

^{1/} Average annual values

^{2/} Watershed



Selected Plan
Cedar Run Watershed Project, Fauquier County, Virginia
REGIONAL DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measure of effects</u>		<u>Components</u>		<u>Measures of effects</u>	
	<u>Regional 1/</u>	<u>Rest of Nation</u>			<u>Regional 1/</u>	<u>Rest of Nation</u>
B. Employment			B. Employment			
Beneficial effects:			Adverse effects:			
1. Increase in the number and types of jobs			1. Decrease in number and types of jobs		None	-
a. Employment for project construction	Average of 12 semi-skilled jobs annually during installation	-				
b. Employment for Operations, Maintenance & Replacement	10 permanent semi-skilled jobs annually	-	Net beneficial effects		10 permanent semi-skilled jobs annually Average of 12 semi-skilled jobs for 8 years	-

1/ Watershed



Selected Plan
 Cedar Run Watershed Project, Fauquier County, Virginia
 REGIONAL DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measures of effects</u>	
	<u>Regional 1/</u>	<u>Rest of Nation</u>
C. Population Distribution		
Beneficial effects	Create 12 semi-skilled jobs for the 8 years during project installation, and 10 permanent semi-skilled jobs in connection with the utilization of project features and their operation and maintenance.	-
Adverse effects	None known	

1/ Watershed



Selected Plan
Cedar Run Watershed Project, Fauquier County, Virginia

SOCIAL WELL-BEING ACCOUNT

<u>Components</u>	<u>Measures of effects</u>
Beneficial and adverse effects:	
A. Real income distribution	<ol style="list-style-type: none"> 1. Create 10 low to medium income jobs with semi-skilled requirements for local residents. 2. Create regional income benefit distribution of \$433,470. 3. Local costs to be borne by the region total \$95,955.
B. Life, health and safety	<ol style="list-style-type: none"> 1. Protect existing road system in project area from significant damage by the 100-year frequency storms. 2. Provide for expansion of public water systems to serve about 30 percent of the population projected for Fauquier County in 1985. 3. Homes with complete kitchen plumbing are expected to increase from 84 percent (1970) to 90 percent and those with flush toilets from 80 percent (1970) to 90 percent by 1985. 4. Sediment accumulation will be reduced in the Warrenton and Occoquan water supply reservoirs, and Lake Jackson.
C. Recreational opportunities	<ol style="list-style-type: none"> 1. Create opportunity for an estimated 20,000 recreation visits annually for public fishing in the reservoirs at structures 4 and 6.



Selected Plan
Cedar Run Watershed Project, Fauquier County, Virginia
ENVIRONMENTAL QUALITY ACCOUNT

<u>Components</u>	<u>Measures of effects</u>	<u>Components</u>	<u>Measures of effects</u>
Beneficial and adverse effects:			
A. Areas of natural beauty	<ol style="list-style-type: none"> 1. Create 7 lakes with a total surface area of 486 acres in an area with few open water vistas. 2. Inundate 7.7 miles of streams. 3. Inundate or occupy with structures, 596 acres now in cropland, pasture land, forest and other uses. 4. Intermittent interruption of use of 672 acres now in crops, pasture, forest, or other uses. 	C. Biological resources and selected ecosystems.	<ol style="list-style-type: none"> 1. Enlarge by 486 acres habitat for fish and waterfowl. 2. Provide resting areas at 7 lakes for migratory waterfowl. 3. Inundate 7.7 miles of stream having 15 to 30 fish of usable size per mile. 4. Improve wildlife habitat on 150 acres 5. A decrease of 596 acres of terrestrial wildlife habitat committed to reservoirs, dams and emergency spillways (approximately 0.9 percent of the project area).
B. Quality considerations of water, land and air resources	<ol style="list-style-type: none"> 1. Reduce erosion on 22,946 acres of cropland, pastureland, forest land, urban and other lands. 2. Reduce sediment leaving the watershed by about 27,738 tons annually. 3. Provide high quality source for public water supplies. 4. Increased air pollution from increased vehicular traffic. 5. Reduce sediment entering the Potomac River and Chesapeake Bay. 6. Provide water storage allowance for release during dry periods. 7. Reduce gross erosion rates from 5.8 to 3.5 tons per acre per year. 	D. Irreversible or irretrievable commitments	<ol style="list-style-type: none"> 1. Commitment to structures, reservoirs flood pools, open and green spaces of 1,268 acres presently in crops, pasture, forest land, and other uses.



PART II

FINAL

ENVIRONMENTAL IMPACT STATEMENT

CEDAR RUN WATERSHED

FAUQUIER COUNTY, VIRGINIA



USDA-SCS-EIS-WS-(ADM)-76-1- (F) VA
CEDAR RUN WATERSHED PROJECT
FAUQUIER COUNTY, VIRGINIA

FINAL ENVIRONMENTAL IMPACT STATEMENT

D. N. Grimwood, State Conservationist
Soil Conservation Service

SPONSORING LOCAL ORGANIZATIONS

John Marshall Soil and Water Conservation District

Edwin F. Gulick, Chairman
Catlett, Virginia 22019

Fauquier County, Virginia
James F. Austin, Chairman
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Warrenton, Virginia 22186

Town of Warrenton
J. Willard Lineweaver, Mayor
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Warrenton, Virginia 22186

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Richmond, Virginia 23240

December 1975



USDA FINAL ENVIRONMENTAL IMPACT STATEMENT

CEDAR RUN WATERSHED PROJECT

FAUQUIER COUNTY

VIRGINIA

SUMMARY

- I. Final
- II. Soil Conservation Service
- III. Administrative
- IV. Description of Project Purpose and Action:

A project for watershed protection, flood prevention, and municipal and industrial water storage in Fauquier County, Virginia, to be implemented under authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83rd Congress, 68 Stat. 666), as amended.

- V. Summary of Environmental Impacts Including Favorable and Adverse Environmental Effects:

Average annual damages will be reduced by approximately 66 percent, allowing for more efficient and effective use of about 3,013 acres of agricultural flood plain. This will lower the cost of farm production and increase farm income. The amount of sediment leaving the watershed will be reduced by approximately 27,738 tons annually as a result of land treatment, trapped sediment, and land use changes. Sediment damages to Warrenton Reservoir, Lake Jackson, the Occoquan Reservoir, and the navigable channels of the Potomac River and Chesapeake Bay will decrease.

Land treatment measures on 22,946 acres of watershed land and land use changes will reduce gross erosion rates from 5.8 to 3.5 tons per acre per year, will retard runoff, will improve wildlife habitat, and will enhance the esthetic values of the watershed. The project will create 486 acres of warm water fisheries and waterfowl habitat, and will improve wildlife

habitat on 150 acres. The seven impoundments will inundate 7.7 miles, or 7.5 percent of the perennial streams, and 104 acres (0.5 percent) of forest wildlife habitat and 382 acres (1.7 percent) of pastureland. As a result of flood protection, 458 acres of forest wildlife habitat in the protected flood plain will be converted to cropland and pasture. There is no marsh or wetland habitat in the watershed.

Facilities will be provided for an estimated 20,000 annual recreation visits. This project will inundate or restrict the land use of approximately 1,421 acres presently in cropland, pastureland, and forest and other uses. Of this total, 672 acres in the flood pools, which are about 25 percent wooded, will only be flooded occasionally. While wildlife habitat patterns will be disrupted during flooding, flowage easements will protect these areas of wildlife habitat from future development.

This project, by providing high quality municipal and industrial water storage, will permit the orderly expansion of public utilities as an integral part of planned county-wide system in an area undergoing development pressure. It will create approximately 100 man-years of employment during construction and 10 permanent jobs. Certain economic and social living conditions in the area will be improved by controlling floodwaters. Construction will temporarily increase stream turbidity in the construction area and downstream.

After the project is complete, activity in the area in and near the recreation facilities will increase. It will also increase vehicular traffic, cause noise pollution, increase the fire hazard, and create a need for services to dispose of solid waste and litter as a consequence of the influx of people in search of recreation activities, mainly fishing.

During severe drought periods, there could be a maximum of 93 acres exposed due to drawdown of reservoirs for water supply. Water storage allowance will be provided at the Auburn site 6, Licking Run site 4, and Airlie site 3 for flow management.

One family residence will be relocated, and the county's tax base will increase due to increased property values near bodies of water and areas benefiting from flood protection.

VI. Alternatives Considered:

(A) Accelerated Land Treatment Only

Nonstructural Alternative - (A) Land Treatment with Acquisition of flood plain land and flood plain properties.

Structural Alternative - (A) Land Treatment and Single-Purpose Water Supply Structures.

No Project.

VII. Agencies from which written comments have been received:

Federal:

- Department of the Army
- Department of the Interior
- Department of Transportation
- Environmental Protection Agency
- Advisory Council on Historic Preservation

State and Local:

- Virginia Soil and Water Conservation Commission
- Commonwealth of Virginia, Office of the Governor, Council on the Environment
- Virginia Division of State Planning and Community Affairs (State Clearinghouse)
- Virginia State Water Control Board
- Virginia Department of Health
- Virginia Commission of Game and Inland Fisheries
- Virginia Air Pollution Control Board
- Virginia Commission of Outdoor Recreation
- Virginia Department of Agriculture and Commerce
- Virginia Department of Conservation and Economic Development
- Virginia Marine Resources Commission
- Rappahannock-Rapidan Planning District Commission (Areawide Clearinghouse)

VIII. Draft Statement transmitted to Council on Environmental Quality on July 11, 1975.

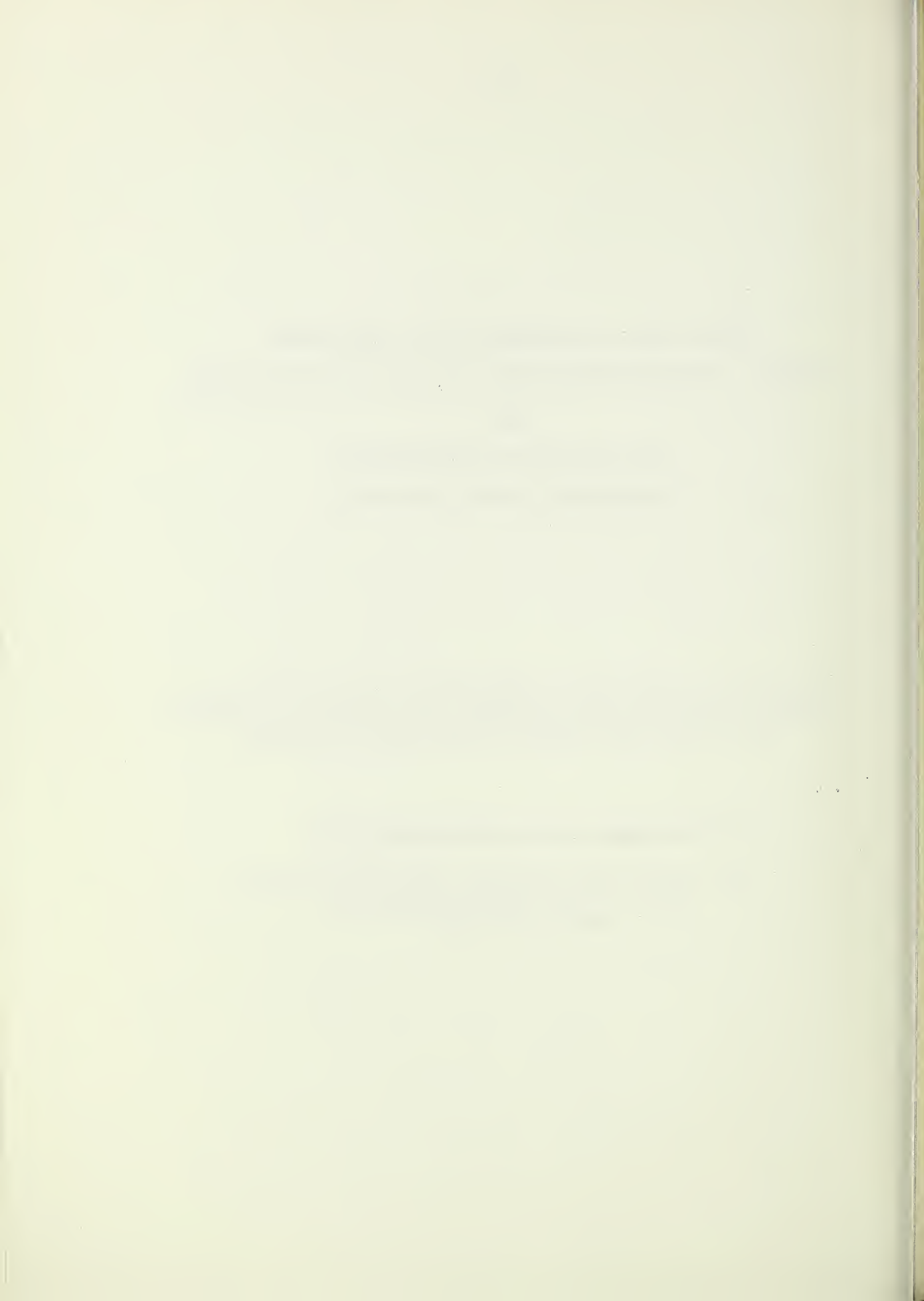


USDA SOIL CONSERVATION SERVICE
FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR
CEDAR RUN WATERSHED
FAUQUIER COUNTY, VIRGINIA

Installation of this project constitutes an administrative action.
Federal assistance will be provided under authority of Public
Law 83-566, 83d Congress, 68 Stat. 666, as amended

SPONSORING LOCAL ORGANIZATIONS

John Marshall Soil and Water Conservation District
Fauquier County Board of Supervisors
Town of Warrenton



PROJECT PURPOSES AND GOALS 1/

Overall goals that the sponsors established for the project at the time of application and as modified in the early stages of planning are: (1) to maintain the natural resource base for sustained use; (2) to improve and protect the environment, to provide attractive, convenient, and satisfying places to live, work, and play; (3) to elevate family standards of living based on community, wholesome leisure, and cultural and educational opportunities; and (4) to help meet man's requirements for goods and services while the natural environment is maintained in a quality condition. The planned project may not or cannot provide for all of these stated goals. The project sponsors, the public, and the Soil Conservation Service came to agreement on purposes for the proposed watershed plan which would help obtain the watershed goals. These purposes are: (1) watershed protection; (2) flood prevention; and (3) municipal and industrial water supply.

The purpose of watershed protection will be achieved through the installation of land treatment measures on a minimum of 75 percent of the farm land by the end of the project installation period. A survey showed erosion to be a continuing problem. Among the sources of erosion are unvegetated road cuts and fills, poor tillage practices on cropland, overgrazed pasture, poor practices involved in harvesting forest products, and poor construction practices in areas undergoing development for nonagricultural uses.

Technical assistance for resource inventories, for development of land use, conservation and woodland management plans and for assistance in installation of key conservation practices are important considerations in achieving desired levels of watershed protection. Measures included in plans must recognize the present condition and needs of the land and its committed use. Lands expected to change to residential and urban use, as well as crop, grass and forest land not adequately protected, are a vital concern. Maintenance of adequate protection of other land is also important. Control of erosion and sediment at or near its source is the principal goal of watershed protection.

Protection of agricultural lands, bridges, and highways from flooding are a concern. Goals were set up to carry out the purpose of flood prevention. The goals are to provide a minimum of 2-year frequency protection to at least 50 percent of the flood plain in the

1/ All information and data, except as otherwise noted, were collected during the watershed planning investigation conducted by the Soil Conservation Service and Forest Service, of the U.S. Department of Agriculture.

benefited area of the watershed and to provide protection of all existing highways in the project area from significant damage from the 100-year frequency storm.

The need for additional sources of water is a vital concern especially as it is a necessity for sustaining life and also a necessity for continuing the economic growth in the area. Present needs are being taken care of but based on industrial needs and population projections, problems of supplying water will exist in the future. Therefore, goals were set to provide water storage for the county in two structures and water for the town of Warrenton in one structure to help meet future water requirements.

Although no project purpose was set up for fish and wildlife and recreation, agreement was made to set a goal of providing recreation areas at two of the structure sites. This would include public access roads, parking, boat ramps, sanitary facilities, and recreational developments compatible with public water supply. Also existing fish and wildlife resources of the watershed would be preserved by incorporation of wildlife habitat improvements in planned land treatment measures.

PLANNED PROJECT

The John Marshall Soil and Water Conservation District, the town of Warrenton, and the Fauquier County Board of Supervisors, the sponsoring local organizations, will be responsible for the successful application of this project. Their responsibilities will be established by memoranda of understanding, and they will be aided through cooperative agreements with other agencies, individuals, and organizations.

An installation period of 8 years has been established for the measures proposed. Land treatment measures will be installed at a reasonably uniform rate during the entire project installation period. It is anticipated that the structural designs will be initiated during the first year and construction substantially completed by the end of the seventh year, leaving only minor items and final project administration activities to complete the project during the eighth year.

LAND TREATMENT MEASURES

The John Marshall Soil and Water Conservation District will coordinate technical assistance offered to landowners throughout the project area. The Forest Service, through its cooperative programs with the Virginia Division of Forestry, and the Soil Conservation Service will provide technical assistance through the John Marshall Soil and Water Conservation District. Technical assistance will provide an estimated 160 resource inventory evaluations; prepare an estimated 98 forest management plans including 20 forest environmental plans; 100 conservation plans; 12 plan revisions; and will assist with the installation of measures included in those plans. Technical assistance is also available for the operation and maintenance of measures previously applied to lands now adequately treated.

Present land use within the project area includes: 12,757 acres of cropland, 22,987 acres of pastureland, 23,178 acres of forest land, and 6,595 acres of other land. Land treatment measures have been applied through the going conservation programs in Fauquier County prior to the development of this plan. Based on an inventory of conservation needs in the project area, prepared by the John Marshall Soil and Water Conservation District, additional land treatment measures should be applied to the land. It is anticipated that 4,550 acres of cropland, 8,200 acres of pastureland, 9,776 acres of forest land, and 420 acres of miscellaneous land will receive conservation treatment during the project installation period. Changes in land use acreages within the project area will require a periodic reevaluation of the conservation needs inventory.

Cropland - Four thousand five hundred and fifty acres of cropland within the project area require varying degrees of conservation land treatment. These cropland acres are major sources of soil erosion,





Fig. 1 Contour Stripcropping - Fauquier County



Fig. 2 Corn and Hay Grown in Strips
near Casanova

contributing to the overall sedimentation problem, and therefore deserve special conservation attention. Conservation measures are designed to keep protective cover on the soil as much of the time as possible, and to reduce the slope length of cultivated fields wherever applicable. Many alternative resource management systems which include these measures can be used satisfactorily by the individual landowner. The selection of conservation measures to be installed is based on the need for conservation land treatment on the specific soils and slopes, as they are utilized by the landowner.

Pastureland - Eight thousand two hundred acres of pasture require conservation land treatment within the project area. Adequate cover holds the soil in place, reduces soil compaction resulting from rain-drop impact, adds to the plant nutrients in the topsoil layer, and increases the infiltration rate of water into the soil, all of which contribute to a reduction in runoff and the associated erosion generated by rainfall. Appropriate combinations of planned grazing systems, lime, fertilizer, weed and brush control, reseeding of adapted species, and responsible management contribute to an adequate grassland resource management system.

A good grassland resource management system protects the soil from excessive erosion, increases the production capacity for livestock production, improves the wildlife habitat associated with open spaces, and improves the scenic quality of the landscape.

Forest land - Treatment with varying degrees of intensity is planned on 9,776 acres of forest land within the project area. Fire prevention and insect and disease control are planned for the total 23,178 wooded acres. Combinations of other conservation measures aimed at reducing erosion and improving hydrologic cover conditions are included in forest land management plans and forest environmental plans.

Forest land management plans will be developed for land remaining in permanent forest cover, and will include the installation and maintenance of approved forestry measures. Also included in the technical assistance provided to forest landowners will be forest environmental plans which make provisions for the proper implementation of forest land conversion to urban uses. A forest environmental plan includes guidelines for the installation of erosion control measures, retaining wooded buffer strips for noise reduction and enhancement of visual quality in developing areas, sediment trapping measures, and revegetation of disturbed areas.

Other Land Uses - This category includes 420 acres which are undergoing changes to nonfarm uses and which need land treatment. The actual application of the needed measures will be made by the individual owners or operators based on the site by site needs. Application of the measures will have secondary benefits such as

improvement of the visual quality of the landscape and general enhancement of the environment in addition to control of erosion and downstream sedimentation.

Wildlife habitat management is planned for 150 acres as part of the operators land use management program. These areas incorporate conservation measures on pasture land, forest land, and cropland in order to enhance the habitat of particular species of wildlife.

For all land uses a minimum of 50 percent of the agricultural lands in the project area will be included under cooperative agreement with the John Marshall Soil and Water Conservation District before construction is initiated. Land treatment measures are planned to be installed more or less uniformly over the entire project area, individual landowners are encouraged to plan and install conservation land treatment measures into their operations. Special emphasis will be given to accelerated land treatment in reach S during project installation to prevent eutrophication of the stream channel by nutrient enrichment. Technicians representing the Soil Conservation Service and the Virginia Division of Forestry will be made available to the District to assist them in implementing their conservation land treatment program.

Refer to Appendix D for a listing of typical conservation land treatment practices, and definitions of each.

STRUCTURAL MEASURES

Planned structural measures include four floodwater retarding structures and three multiple-purpose structures, as shown on the project map. All structures will have zoned earth fills. The emergency spillways for structures 4 and 6 are classified as rock; all others are vegetated. The plan is based on yielding foundations for the principal spillways of structures 2, 3, 4, 5, and 7, and it will therefore be necessary to backfill the excavated pipe trenches with suitable borrow material. Preliminary geologic investigations indicate that the principal spillways for structures 1 and 6 may have non-yielding foundations.

Each of the structures is designed to pass the 100-year frequency runoff through the principal spillway system without emergency spillway flow. The seven structures will provide 15,198 acre-feet of flood storage and will control the runoff from 40,895 acres (63.90 square miles) or 62.4 percent of the total watershed area. The floodwater detention capacity is equivalent to 4.46 inches of runoff from the area above structures, or 2.78 inches from the entire watershed project area. These structures have a design life of 100 years and storage is provided for the expected sediment accumulation during this period. The total sediment capacity for all structures will be 3,723 acre-feet, 94.9 percent of which will initially store water.

One of the multiple-purpose structures (#3) will store 500 acre-feet of municipal and industrial water supply for the town of Warrenton. The other two multiple-purpose structures (#4 and #6) will store 500 and 1,000 acre-feet respectively, to be used by Fauquier County for

the same purpose. The water supply storage provided includes allowances for evaporation and seepage losses, and for a downstream release rate equal to the 10-year, 7-day low flow. The sponsors plan to monitor the water quality at each of these sites on a continuing basis, and will take any necessary actions to insure that the intended beneficial uses can be realized. Special precautions will be taken at site #3 to insure that low dissolved oxygen and thermal shock do not cause adverse effects on downstream aquatic systems.

A search of the literature discloses that the last recorded earthquake which may have been felt in Fauquier County was in 1966 with an estimated intensity of IV on the Mercalli scale 1/. No major earthquakes have been recorded in Virginia since 1897. A major earthquake is defined as one with an intensity greater than VIII on the Mercalli scale.

This watershed is in Algermissen's Seismic Risk Zone 2 2/ which has earthquake magnitudes (Richter) 3/ ranging from 4.5 to 6.0 (Magnitude 4.5 = breakage of dishes and disturbances of tall buildings; magnitude 6.0 = walls, monuments, and chimneys fall, and cracks appear in the ground.)

The foundations have no critical earthquake hazards. The characteristics of the borrow materials have been considered in the design of the embankments to minimize earthquake hazards to the structures.

Soil Conservation Service standards and specifications will be used as a guide in preparing construction contracts for this project. Quality control will be based upon industry standards such as those of the American Society for Testing Materials, American Institute of Steel Construction, American Concrete Institute, American Water Works Association, and Federal Specifications and Standards. Soil Conservation Service structure classifications are determined by the damage that might occur to existing and future developments downstream resulting from a sudden breach of the earth embankment and to the structures themselves. Design criteria for a given structure is then based on the selected classification.

All construction activities will be performed under intensive inspection by qualified personnel. After completion of the project, inspections will be made annually, after severe floods, and after the occurrence of any other unusual conditions to determine safety hazards, and operation and maintenance needs.

1/ Hopper, M. G., and Bollinger, G. A., The Earthquake History of Virginia, Department of Geological Sciences, Virginia Polytechnic Institute and State University, 1971, 1972.

2/ Algermissen, S. T., Seismic Risk Map of the United States, 1969.

3/ Gutenberg, B., and Richter, C. F., Seismicity of the Earth, GSA Spec. Paper 34, 1941; also published by the Princeton University Press.

The appurtenant features for water supply will be similar for each of the three multiple-purpose structures. Each structure will have a separate intake riser with three 12-inch slide gates, and a 12-inch cast iron water main with a cutoff valve. The intake riser for each of the structures will be located in the upstream toe of the dam, and will have a catwalk for access. The three slide gates for each structure will be located at different elevations, the lower one being at the sediment pool level. The water mains through the Auburn site 6 and Licking Run site 4 will empty directly into adjacent pumping stations, whereas water at the Airlie site 3 will be released into the stream and picked up at the water treatment plant near Warrenton. Nonproject features consist of the pumping stations, water treatment plants, and distribution systems.

During construction appropriate measures will be taken to minimize soil erosion as well as water, air, and noise pollution. These measures will be determined for the individual site by evaluating the pollution hazard in relation to established standards for the area in question. The plans and specifications for the structure will include pollution control measures such as sediment and debris basins, diversions, temporary stream crossings, dust suppressors, temporary vegetation, etc. It is estimated that a maximum of 17.5 acre-feet of sediment will be produced at the seven sites during construction. The onsite erosion control measures will reduce this amount by 60 percent to 7.0 acre-feet. The following table gives a breakdown of the estimated sediment concentration for the seven sites. The sequence of operations will also be specified in order to minimize the pollution hazard. After construction is completed, an adequate sod will be established on all disturbed areas within one growing season.

ESTIMATED SEDIMENT CONCENTRATION AT CEDAR RUN SITES

Site Number	Present	Construction Period	Future
	Milligrams Per Liter		
1	1,946	2,072	76
2	832	1,370	76
3	1,210	1,635	116
4	640	1,004	51
5	645	1,009	31
6	829	895	52
7	969	1,161	26

The contractor will be required to keep the project site and access roads in an orderly condition. Upon completion of the work, he will be required to remove all buildings, debris, unused material, forms, etc. from the areas specified. All debris, removed from either the cleared or the cleared and grubbed areas, will be disposed of in an acceptable manner. Any solid or liquid wastes which might cause pollution will be handled in accordance with applicable state and local laws. Vector control, where necessary, will be accomplished through the use of local drainage and approved insecticides. The

contractor will also be required to comply with the provisions of the Construction Safety Act of 1969 (PL-91-54) and applicable state regulations governing open burning and fugitive dust.

Landscape management design will be considered as an integral part of the plans and specifications for each of the seven sites, especially site 4 and site 6 which will be used for public recreation. Specific provisions for managing the landscape of the structure sites and contiguous areas will include measures to preserve and enhance the landscape resources at each site.

Installation of the seven dams will require the purchase of, or flowage easements on, 1,421 acres of land; 486 acres in the sediment and water supply pools, 672 acres in the flood detention pools, 153 acres between the emergency spillway crest and design high water elevations, and 110 acres in the construction areas. Current land use in the areas to be inundated by the sediment and water supply pools is 382 acres of pasture and 104 acres of forest and other uses. Land use in the flood detention pool areas, areas between the sediment or water supply pool and the emergency spillway crest is currently 45 acres of cropland, 458 acres of pasture and 169 acres of forest and other uses. The area between the emergency spillway crest and design high water elevations is 10 acres of cropland, 104 acres of pasture, and 39 acres of forest and other uses. Current land use in the construction areas is 99 acres of pasture and 11 acres of forest and other uses.

Investigations by the sponsors have disclosed that, under present conditions, installation of structure no. 6 will result in the displacement of one family, but no business or farm operations. No displacements will result from installation of the other six dams. Fauquier County will provide the necessary relocation assistance advisory services and relocation assistance. Relocation payments will be cost-shared in accordance with the percentages shown in the Watershed Plan Agreement.

Fauquier County will develop sites 4 and 6, separate and apart from this plan, which they will own and operate for public recreation. Eighteen acres on the east side of the reservoir near site 4, and 10 acres on the north side of the reservoir near site 6, will be purchased by the county for this purpose. The county will secure permanent landrights for access roads, in order to assure public access to the lakes for fishing and other incidental recreation. The construction roads from Highway No. 602, which is near both of the sites, will serve this function. Facilities to provide for public use at each of the two sites will include access roads, boat ramps, parking areas for cars and boat trailers, picnic tables, trash receptacles, and modern sanitary facilities as required by state and local health laws and regulations. These facilities will be adequate for full use of the lakes (20,000 visits per year). All facilities will be designed to provide safety for all users, and will include provisions for use by handicapped persons. Responsibility for operation and maintenance will be assumed by the county.

These reservoirs are to be used for storage of municipal water; therefore, activities such as swimming, wading, and water skiing will be prohibited. Boating will also be limited to small craft, with electric motors. There are no pollution sources which threaten the water supply reservoirs with contamination. Fauquier County will exercise its police and regulatory authority as needed to insure the water supply reservoirs do not become contaminated.

The Virginia Commission of Game and Inland Fisheries will stock the reservoirs with largemouth bass, bluegill sunfish, channel catfish, and possibly other warm-water species. They will also manage the fishery, which will furnish bank and boat fishing on a total of 248 surface acres.

Each of the remaining sites (Nos. 1, 2, 3, 5, and 7) has some potential for incidental public recreation and each was considered for such development by the sponsors. After a careful analyses, however, they concluded that the costs and other problems of development exceeded the anticipated benefits at each site. These problems included the additional cost of landrights, facilities, policing, and operation and maintenance. Specific problems include small impoundment size (especially sites 2 and 7), incompatible uses and landrights restrictions (site 3), physical limitations (especially site 5) and high land values (especially site 1). Neither Fauquier County nor the town of Warrenton will allow public access to these sites, or issue a permit for use by other interests, until facilities which meet all health and sanitary requirements by state and local government are provided. The general public will be prohibited from using the sites not developed for recreation through cooperative agreements between Fauquier County, the town of Warrenton, and the affected landowners.

Gates will be installed near the bottom of the reservoir on all structures for the purpose of water flow management. Each of these gates will be sized to release amounts up to normal flow at the respective site. Additional storage will be available in the three multiple-purpose sites for a guaranteed release rate equal to the 10-year, 7-day low flow (0.067 cfs for #3, 0.305 cfs for #4, and 0.615 cfs for #6). The purpose of this downstream release is to offset the effects of diverting water for municipal and industrial uses. No such storage was provided in the other four sites since low-flow augmentation is not a project purpose. However, Virginia state law requires that the flow below an impoundment be at least equal to the flow immediately above the structure when that flow is equal to or less than the average flow. These gates will provide the necessary means for releasing the required downstream flows.

The Virginia Historic Landmarks Commission made a study and reported three historical places within the watershed which are of historical interest but will not be adversely affected by the actual installation of this project. The State Archeologist, through his studies, identified no archeological sites that will be affected by project construction. Both the Commission and the State Archeologist feel there is little likelihood of the existence of historic or archeological values within the areas to be disturbed by construction. Even so, these offices and the National Park Service will be notified in the event any previously unidentified evidence of cultural values are discovered during detailed investigations or construction. Procedures outlined in P.L. 93-291 will be followed. Since this is a federally assisted local project, there will be no change in agency responsibilities of any federal agency under Executive Order 11593 with respect to archeological and historical resources.

Features peculiar to each site were considered and findings, along with recommendations, are included under the following individual site headings.

Site No. 1, Turkey Run - This site is located on the Turkey Run tributary 0.3 mile upstream from Highway No. 602. It has a drainage area of 9.68 square miles. Storage amounts for this structure are 2,333 acre-feet for floodwater and 795 acre-feet for sediment. The structure will have a 300-foot vegetated emergency spillway, and a principal spillway system consisting of a drop inlet riser, a 42-inch reinforced concrete pipe, and an impact basin.

The dam will be about 61 feet high, and will be constructed of approximately 206,900 cubic yards of compacted fill, including 5,900 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway excavation will yield approximately 149,000 cubic yards of silty sand and sandy silt (SM and ML), and approximately 3,400 cubic yards of rock. The remaining 54,500 cubic yards of fill, which is available along the right abutment below the permanent pool elevation, consists of the same material.

Site No. 2, Gupton Run - This site is located on Gupton Run, a tributary to Turkey Run, 0.1 mile upstream from Highway No. 602. It has a drainage area of 2.48 square miles. Storage amounts for this structure are 470 acre-feet for floodwater and 232 acre-feet for sediment. The structure will have a 200-foot vegetated emergency spillway, and a principal spillway system consisting of a drop inlet riser, a 30-inch reinforced concrete pipe, and an impact basin.

The dam will be about 42 feet high, and will be constructed to approximately 84,300 cubic yards of compacted fill, including 5,000 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway excavation will yield approximately 18,800 cubic yards of

silty sand and sandy silt (SM and ML), and approximately 3,600 cubic yards of rock. The remaining 61,900 cubic yards of fill, which is available along the right abutment above the permanent pool elevation, consists of the same material.

Site No. 3 Main Stem - This site is located on the main stem of Cedar Run 1.0 mile upstream from the Warrenton water supply dam, and on the Airlie property. It has a drainage area of 3.53 square miles. Storage amounts for this structure are 846 acre-feet for floodwater, 297 acre-feet for sediment, and 500 acre-feet for water supply. The structure will have a 250-foot vegetated emergency spillway, and a principal spillway system consisting of a drop inlet riser, a 30-inch reinforced concrete pipe, and an impact basin.

The dam will be about 53 feet high, and will be constructed of approximately 261,600 cubic yards of compacted fill, including 23,600 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway excavation will yield approximately 2,700 cubic yards of silty sand and sandy silt (SM and ML). The remaining 258,900 cubic yards of fill, which is available along both abutments below the permanent pool elevation, consists of the same material.

Site No. 4, Licking Run - This site is located on the Licking Run tributary 0.1 mile upstream from Highway No. 602. It has a drainage area of 16.03 square miles. Storage amounts for this structure are 3,599 acre-feet for floodwater, 661 acre-feet for sediment, and 500 acre-feet for water supply. The structure will have a 400-foot rock spillway with a Case IV layout to increase the effective bulk length, while decreasing the overall entrance length. The principal spillway system will consist of a drop inlet riser, a 48-inch reinforced concrete pipe, and an impact basin.

The dam will be about 62 feet high, and will be constructed of approximately 460,500 cubic yards of compacted fill, including 28,000 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway excavation will yield approximately 223,700 cubic yards of silty sand and gravel (SM and GM), and 200 cubic yards of rock excavation will come from site preparation. The remaining 236,600 cubic yards of fill, which is available along the right abutment above and below the permanent pool elevation, consists of silty sand and sandy silt (SM and ML).

Site No. 5, Owl Run - This site is located on the Owl Run tributary 0.6 mile upstream from Highway No. 28. It has a drainage area of 3.35 square miles. Storage amounts for this structure are 915 acre-feet for floodwater and 207 acre-feet for sediment. The structure will have a 200-foot vegetated emergency spillway, and a principal spillway system consisting of a drop inlet riser, a 30-inch reinforced concrete pipe, and an impact basin.

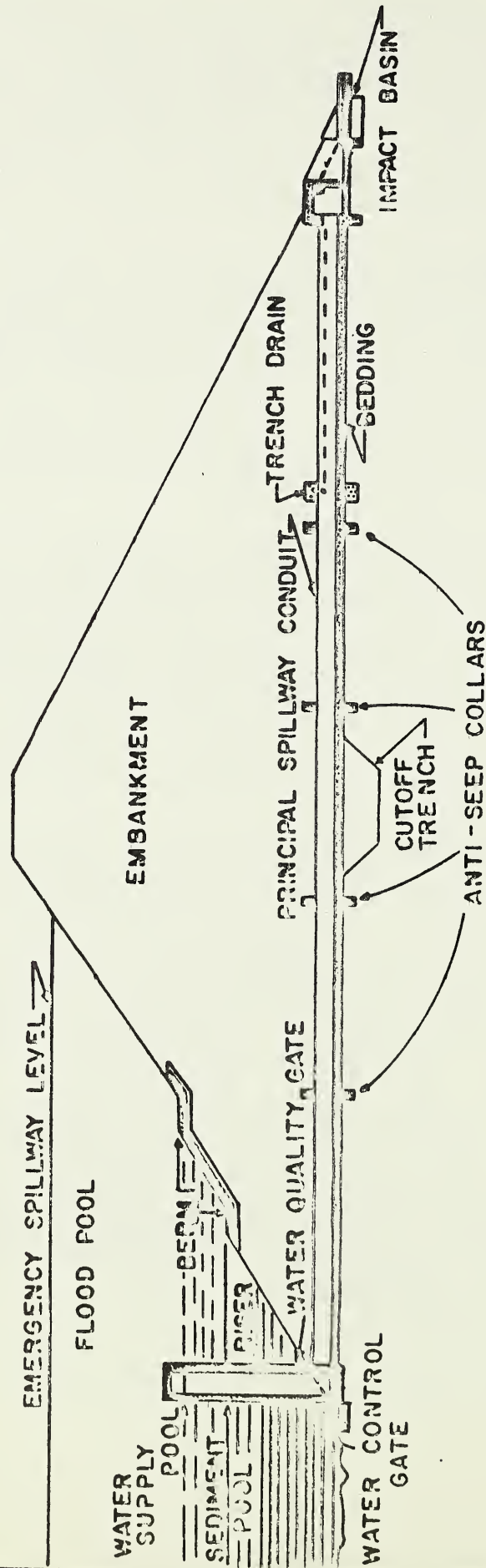
The dam will be about 29 feet high, and will be constructed of approximately 56,300 cubic yards of compacted fill, including 2,700 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway excavation will yield approximately 16,000 cubic yards of silty sand and sandy silt (SM and ML), and approximately 2,300 cubic yards of rock. The remaining 38,000 cubic yards of fill, which is available along the left abutment above the permanent pool elevation, consists of the same material.

Site No. 6 - Main Stem - This site is located on the main stem of Cedar Run 0.3 mile upstream from Highway No. 670 near the Auburn community. It has a total drainage area of 32.36 square miles, of which 10.48 square miles is controlled by structures 3 and 7. Storage amounts for this structure are 5,283 acre-feet for floodwater, 1,166 acre-feet for sediment, and 1,000 acre-feet for water supply. The structure will have a 500-foot rock spillway, and a principal spillway system consisting of a drop inlet riser, two 54-inch reinforced concrete pipes, and a SAF outlet.

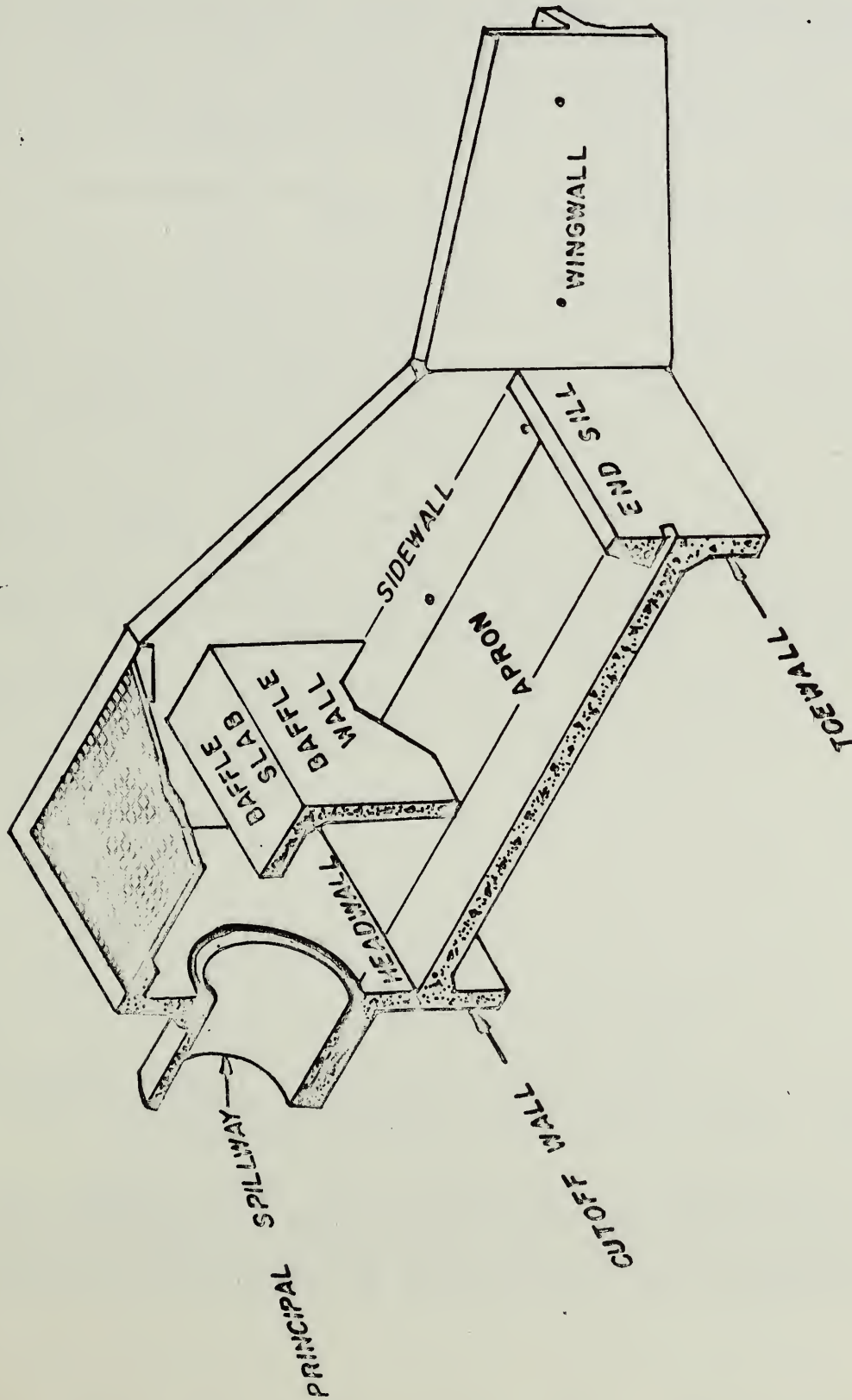
The dam will be about 74 feet high, and will be constructed of 397,600 cubic yards of compacted fill, including 11,500 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway excavation will yield approximately 197,600 cubic yards of silty sand and sandy silt, with some silty clay (SM, ML, and CL), and approximately 146,800 cubic yards of rock. Another 1,000 cubic yards of rock will come from site preparation. The remaining 52,200 cubic yards of fill, which is available along the right abutment below the permanent pool elevation, consists of silty sand and sandy silt (SM and ML).

Site No. 7, Mill Run - This site is located on the Mill Run tributary 0.7 mile upstream from its junction with Cedar Run. It has a drainage area of 6.95 square miles. Storage amounts for this structure are 1,750 acre-feet of floodwater and 365 acre-feet for sediment. This structure, which is upstream from structure No. 6, is necessary because of topographic limitations at the lower site. The structure will have a 250-foot vegetated emergency spillway, and a principal spillway system consisting of a drop inlet riser, a 36-inch reinforced concrete pipe, and an impact basin.

The dam will be about 60 feet high, and will be constructed to approximately 173,900 cubic yards of compacted fill, including 9,000 cubic yards of backfill for the cutoff and pipe trenches. The emergency spillway excavation will yield 29,200 cubic yards of silty sand (SM). The remaining 170,800 cubic yards of borrow, which is available along the left abutment above the permanent pool area, consists of silty sand and sandy silt (SM and ML).



SECTION OF A TYPICAL WATER SUPPLY AND
FLOODWATER RETARDING STRUCTURE



SECTION OF A TYPICAL IMPACT BASIN

FIG. 4

OPERATION AND MAINTENANCE

Land treatment measures will be operated and maintained by landowners and operators through cooperative agreements with the John Marshall Soil and Water Conservation District.

Fauquier County will operate and maintain the four floodwater retarding structures (Nos. 1, 2, 5, and 7) at an estimated annual cost of \$1,000 each, and of the two multiple-purpose structures (Nos. 4 and 6) at an estimated annual cost of \$2,000 each. The town of Warrenton will operate and maintain the other multiple-purpose structure (No. 3) at an estimated annual cost of \$1,500. Structure number 3 will be operated so that changes in dissolved oxygen and temperature do not adversely affect downstream aquatic systems.

Typical operation items will include the operation of gates for water supply and flow management, the removal of trash and debris from the pools and structures after floods, and the closing of roads affected by floodwater storage and posting of warnings to motorists. Vegetative maintenance items will include mowing, fertilizing, reseeding, weed control, and grazing control for vegetated areas. Maintenance of the earth dams may include replacement and revegetation of eroded areas in the vegetated spillways or on the dams, inspection and clean-out of drainage systems, and replacement of rock riprap as needed. Maintenance of appurtenant structures may include removal of debris from the trash racks and impact basins, maintenance of gates and valves, repainting of all surfaces requiring protection by paint, and repairing or replacing of signs as needed.

The Virginia Commission of Game and Inland Fisheries will stock two of the multiple-purpose structures (Nos. 4 and 6) with warm-water game fish and manage the fishery. Resources and facilities provided for public fishing will be operated, maintained, and replaced as necessary by Fauquier County. The county will also operate and maintain sanitary facilities as required by state and local health laws and regulations to allow full use of the lake for fishing and other incidental recreation. In addition, the county will repair and replace recreational equipment and facilities, develop and enforce regulations for use of recreational facilities, restrict motor vehicles to designated roads and parking areas, prevent pollution to water used for public consumption and/or recreation, dispose of garbage and other refuse, and eliminate safety hazards. Public access to the sites has been assured by the county. Fauquier County will exercise its police and regulatory authority as needed to insure the water supply reservoirs do not become contaminated.

Funds for operation and maintenance of the fishery resources and facilities provided for public recreation will be obtained from user fees, not to exceed that amount required to defray operation and maintenance costs and to recover the county's initial investment.

Designated representatives of the Soil Conservation Service and the sponsors will jointly make an inspection annually, after severe floods, and after the occurrence of any other unusual conditions that might adversely affect the structures. These inspections will continue for 3 years following installation of the dams. Inspections after the third year will be made by the sponsors. They will prepare a report, and furnish a copy to the Service employee responsible for the inspection follow-up activities. These reports will be thoroughly reviewed by the Service representative. Any evidence of needed inspections, or maintenance not being performed properly, will be reported immediately and appropriate action taken by the responsible sponsors.

Specific operation and maintenance agreements will be executed prior to signing a landrights, relocation, or project agreement. In addition to specific sponsor responsibilities for nonstructural and structural project measures, these agreements will also contain specific provisions for retention and disposal of real and personal property acquired in whole or in part with P.L. 566 funds. The operation and maintenance agreements will contain a reference to the Virginia Operation and Maintenance Handbook and an operation and maintenance plan will be prepared for each structural measure.

PROJECT COSTS

Total project installation cost is estimated to be \$4,899,260. Public Law 566 funds will provide \$2,779,594 and other funds \$2,119,666 of this amount. Total installation cost of structures is estimated to be \$4,099,680; with P.L. 566 funds providing \$2,633,094 and other funds \$1,466,586 of this amount.

ENVIRONMENTAL SETTING

PHYSICAL RESOURCES

Cedar Run Watershed lies in the headwaters of the Occoquan Creek Watershed and covers the central and southeastern sections of Fauquier County. Below the P.L. 566 project area Cedar Run extends into Prince William County where it unites with Broad Run to form Occoquan Creek. The Occoquan drains into the Potomac River which in turn outlets to the Atlantic Ocean through the Chesapeake Bay.

As delineated by the Water Resources Council, Cedar Run is in the Potomac subregion (0207) of the Middle Atlantic Region (02) which eventually discharges into the Atlantic Ocean 1/. It is in Major Land Resource Area 148, the Northern Piedmont Area of the Northern Atlantic Slope Truck, Fruit, and Poultry Region 2/.

The P.L. 566 project area comprises 65,517 acres which is 52.3 percent of the total Cedar Run watershed at the confluence with the Occoquan Creek. Thus, the drainage area of the watershed project under consideration is slightly over 100 square miles. Part of the town of Warrenton, county seat of Fauquier County, is located in the northwestern portion of the watershed. The communities of Catlett and Calverton, even though not incorporated as towns, serve as community centers for the lower part of the project area.

Geographically, the western boundary of the project area runs along the ridge line from Rappahannock Mountain south through the communities of Warrenton, Opal, Germantown, and Midland. The southern boundary line extends from the western boundary approximately two miles south of the community of Midland along a ridge line generally parallel with State Route 28. This ridge extends northeasterly to where Cedar Run flows out of Fauquier County into Prince William County.

On the north, the watershed is bounded by the Rappahannock Mountain. The eastern boundary runs southeasterly along a ridge line, intersecting U.S. Highways 15-29-211 about 2.3 miles northeast of Warrenton, to the Fauquier - Prince William County line at State Route 605. See project map appendix B for location of boundaries, towns, roads, and streams.

1/ 1972 OBERS Projections, Regional Economic Activity in the U.S.; Volume 3, April 1974, U.S. Water Resources Council, Washington, D.C.

2/ Austin, Morris E., Land Resource Areas of the United States, Soil Conservation Service, U.S. Department of Agriculture, Agriculture Handbook 296, 1965.

The nearest large urban center is the Washington, D.C. area, about 35 miles to the northeast. Other large urban centers within 200 miles of the watershed include Richmond, Norfolk, and Roanoke, Virginia; Pittsburgh and Philadelphia, Pennsylvania; and Baltimore, Maryland.

Approximately 7,965 people live in the Cedar Run project area. This population is about 40 percent rural and 60 percent urban. The urban population is centered primarily at Warrenton and around the communities of Catlett and Calverton.

Climate - Temperatures in the area average about 36 degrees F. in winter and 74 degrees in summer. Temperatures below zero occasionally occur as overnight lows, but very few days have below-zero temperatures of more than 24 hours' duration. Sometimes, during summer hot spells, the daytime high temperature will reach 100 degrees or more, but this condition will last for only a few days at a time. The lowest official temperature recorded in the area is 8 degrees below zero, and the highest 103 degrees above. The average growing season is approximately 185 days from mid-April to mid-October.

Average annual precipitation is 41 inches, of which about 23 inches normally falls as rain between the first of April and the end of September; the remaining 18 inches falls as rain or snow between the first of October and the end of March.

Stream flow in the Potomac Basin averages somewhat less than 1 cfs per square mile. This supply is not evenly distributed throughout the area for convenient availability at locations of greatest need. Reliable use of stream flows is limited by large annual and seasonal variations in precipitation. The effects of these variations were demonstrated during the drought of the early 1960's. In 1965, after several years of below average streamflow in much of the region, flow in the Potomac River Basin was approximately 60 percent of average. The effects of the drought were severely felt because of the large demands of metropolitan areas, including Washington, D.C., serviced by this river.

In most parts of the region about half of the annual runoff occurs in a three month period, generally in late winter and early spring. The months of lowest average runoff are between June and October, with August and September flows predominantly low.

Excessive rainfall has caused heavy flooding every few years at one or more places. Flooding has occurred at all times of the year; however, floods are more frequent in spring and fall. Most of the severe floods result from heavy spring rainfall and snowmelt or from hurricanes or tropical storms which pass through the area in late summer and fall. Flow variations in the streams of this region are

classified as severe; ratios between high and low flows are as high as 600 to 1 1/.

An estimated 4,503 acres of flood plain land lies below the proposed structural measures. Approximately 1,552 acres of this land is on the main stem of Cedar Run downstream from the project boundary and is sufficiently affected by the proposed flood control structures that the structures will produce measurable benefits. Of the 4,503 acres of flood plain, 2,420 are currently used for cropland and pasture. Another 1,054 acres are included in the Warrenton water supply reservoir and treatment plant, highway rights-of-way, built up areas, and other uses. The remaining 1,029 acres are in forest land or brushy areas, most of which floods too frequently to be used for cropland or pasture. Even though the flood plain soils cover less than 5 percent of the watershed area, they are highly important to each landowner. They are the most fertile and productive soils in the watershed and, when not subjected to flooding, are the least affected by erosion and the most responsive to improved management.

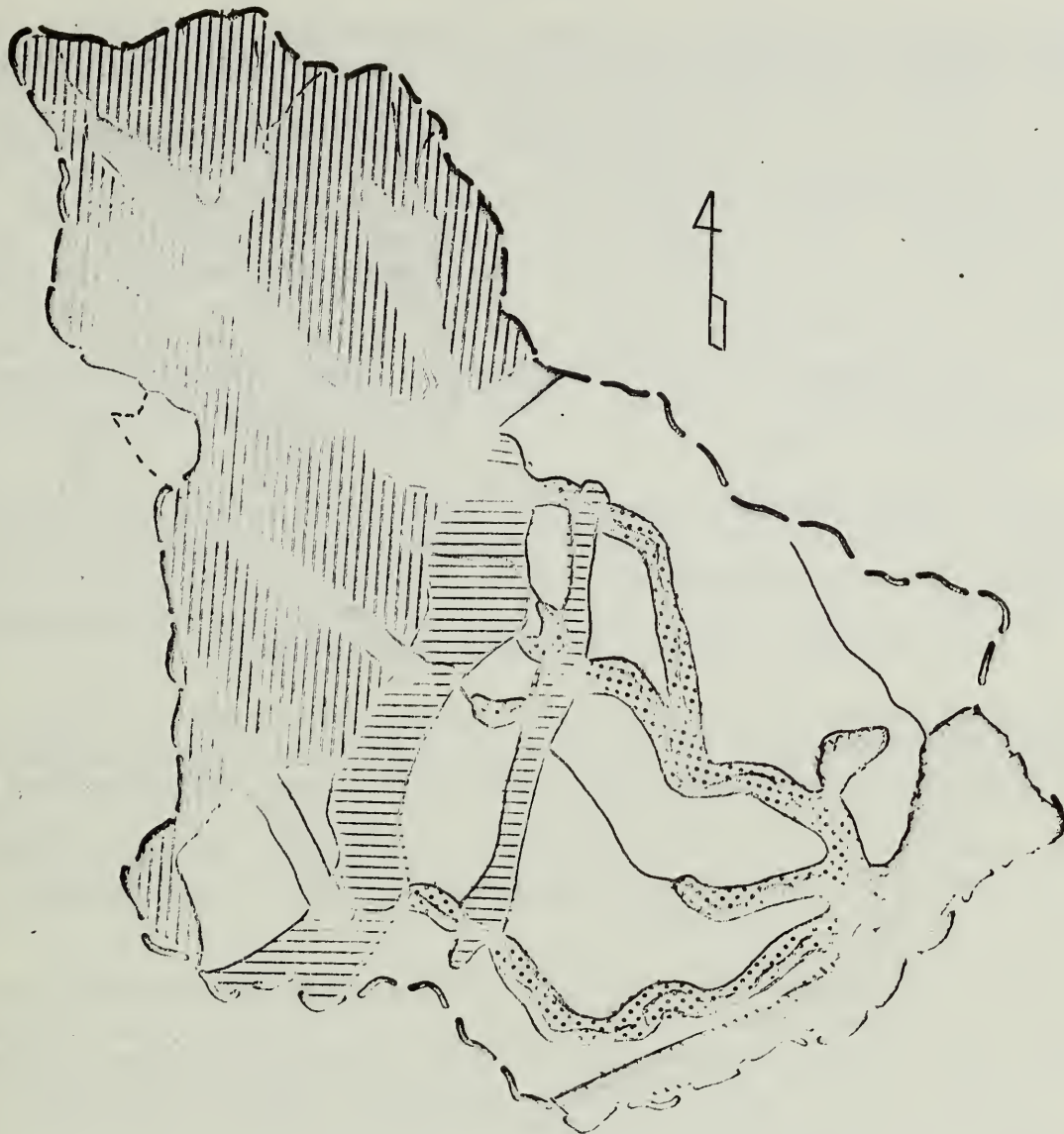
Soils - Groupings of soils with similar origin are called soil associations. Each soil association contains a few major soils and other minor soils in a pattern that is characteristic although not uniform. Following are brief descriptions of the soil associations shown on the general soils map of the Cedar Run Watershed, which drains a portion of Fauquier County, Virginia. See the Soils map.

The Fauquier-Catoctin Association covers the upper reaches which cover approximately one-third of the Cedar Run project area. These soils are generally underlain by greenstone. Fauquier, generally on rolling topography, is a well drained soil with red clay subsoil. It is a naturally fertile soil, growing good crops and pastures. Catoctin, a shallow, excessively drained soil on dominantly hilly relief is relatively fertile and produces good pasture, but because of the topography a high percentage is in forest land.

The Penn-Calverton-Croton Association covers approximately 40 percent of the land area of the Cedar Run project area. It dominates the central and eastern portions of the area. It is underlain by Triassic shale and sandstone. The moderately deep Penn Soils with their characteristic "Indian red" color predominate in this association. There are also important acreages of Calverton and Croton.

The slopes in this association range from nearly level to hilly, but the prevailing relief is undulating. The soils vary considerably in physical characteristics, from moderately deep to shallow, and from excessively drained to poorly drained. Consequently, they also vary considerably in their suitability for agricultural use. About 75 percent

1/ U.S. Department of the Interior; Water Resources Data for Virginia, 1973, Geological Survey p. 51.



SOIL ASSOCIATIONS ON CEDAR RUN WATERSHED








-  1- Fauquier - Catoclin Association
-  2- Braddock - Dyke - Thurmont Association
-  3- Montalto - Zion Association
-  4- Penn - Calverton - Croton Association
-  5- Iredell - Mecklenburg Association
-  6- Bermudian - Rowland - Bowmansville Association
-  7- Congaree - Chewacla - Wehadkee Association

Fig. 5

of the land is cleared and used for crops and pasture. Much of the dairy farming has been concentrated on this soil association.

The Montalto-Zion Association covers approximately 10 percent of the land area of the project area, in a belt starting just east of Opal and extending northward to the north side of Cedar Run.

The Montalto soils predominate in this association. They are moderately deep soils on undulating to rolling topography, are relatively fertile, but moderately shallow to bedrock. The Zion soils usually have a thin plastic subsoil layer which somewhat restricts drainage. It is well suited to pasture, with only moderate suitability for common field crops.

The Iredell-Mecklenburg Association makes up an estimated 8 percent of the land area of the Cedar Run project area. The main body extends across the watershed in a northeast-southwest direction. It lies a mile or more to the east of, and parallel to, State Highway 28. There is also a small area just north of Catlett.

This soil association is generally underlain by diabase. It is mainly on nearly level to gently sloping land. It consists chiefly of Iredell soils associated with smaller acreages of Mecklenburg soils.

The Iredell soils are mostly in woods or pasture. They are fairly well adapted for pasture. A high proportion of the Mecklenburg soil is in crops or pasture.

The Bermudian-Rowland-Bowmansville and Congaree-Chewacla-Wehadkee Associations make up the flood plain soils of the Cedar Run project area. These flood plain soils have quite variable drainage characteristics. Most of these fertile, stone-free easy to till soils are presently being used well below their potential, because of flooding and excess water hazard.

Approximately 70 percent of the flood plain in this watershed is underlain by Triassic rocks. The Bermudian-Rowland-Bowmansville Association makes up the soils within the Triassic Basin. The dominant alluvial soil within the Triassic Basin is Rowland. It is potentially very productive when problems of flooding are corrected. The poorly drained Bowmansville soils make up 15 to 20 percent of the Triassic flood plain soils. These soils are well suited for pastureland, and they also have potential for food production. The well drained Bermudian soils cover an estimated 10 percent. The remaining 30 percent of the flood plain is in the Piedmont uplands portion of the watershed and is underlain by metamorphic and igneous rocks. The Congaree-Chewacla-Wehadkee Association covers this area. Chewacla is the main flood plain soil covering about 75 percent of this area, and is potentially a very productive soil when problems of flooding and drainage are corrected. The well drained Congaree soil is high in organic

matter and plant nutrients; this makes it a significant productive factor, even though it represents only 15 to 20 percent of the area. These soils are on the upper reaches of Cedar Run above Auburn, on Turkey Run, and on Licking Run above Highway 674.

The Braddock-Dyke-Thurmont Soils Association northeast of Warrenton cover approximately one percent of the watershed area. Quartzitic rocks are the parent material.

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

The Soil Conservation Service of the U.S. Department of Agriculture has defined eight land capability classes which are designated by Roman numerals I through VIII. The hazards and limitations of use increase as the Roman numerals increase, defined as follows:

Land Suited for Cultivation and Other Uses

Class I - Soils in class I have few limitations that restrict their use.

Soils in this class are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. The soils are nearly level and erosion hazard (wind or water) is low. They are deep, generally well drained, and easily worked. They hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer.

Class II - Soils in Class II have some limitations that reduce the choice of plants or require moderate conservation practices.

Soils in this class require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated. The limitations are few and the practices are easy to apply. The soils may be used for cultivated crops, pasture, range, woodland, or wildlife food and cover.

Class III - Soils in class III have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Soils in class III have more restrictions than those in class II and when used for cultivated crops, conservation practices are usually more difficult to apply and to maintain. They may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover.

Class IV - Soils in class IV have very severe limitations that restrict the choice of plants, require very careful management, or both.

The restrictions in use for these soils are greater than those in class III and the choice of plants is more limited. When these soils are cultivated, more careful management is required and conservation practices are more difficult to apply and maintain. Soils in class IV may be used for crops, pasture, woodland, range, or wildlife food and cover.

Land Limited in Use - Generally Not Suited for Cultivation

Class V - Soils in class V have little or no erosion hazard, but have other limitations that are impractical to remove and that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Soils in this class have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops. They are nearly level but some are wet, are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations. Because of these limitations, cultivation of the common crops is not feasible but pastures can be improved and benefits from proper management can be expected.

Class VI - Soils in class VI have severe limitations that make them generally unsuited for cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Physical conditions of soils placed in class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing and water control with contour furrows, drainage, ditches, diversions, or water spreaders. Soils in class VI have continuing limitations that cannot be corrected. Due to these limitations these soils are not generally suited for cultivated crops. But they may be used for pasture, range, woodland, or wildlife cover or some combination of these.

Class VII - Soils in class VII have very severe limitations that make them unsuited for cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Physical conditions of soils in class VII are such that it is impractical to apply such pasture or range improvements as seeding, liming, fertilizing, and water-control measures such as contour furrows, ditches, diversions, or water spreaders. Soil restrictions are more severe than those in class VI because of one or more continuing limitations that cannot be corrected, such as very steep slopes, erosion, shallow soil, stones, wet soil, salts or alkalies, unfavorable climate, or other limitations that make them unsuited for common cultivated crops. They can be used safely for grazing or woodland or wildlife food and cover, or some combination of these under proper management.

Class VIII - Soils and land forms in class VIII have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

Soils and land forms in class VIII cannot be expected to return significant on-site benefits from management for crops, grasses, or trees, although benefits from wildlife use, watershed protection, or recreation may be possible.

In this watershed, some of the class II soils would be class I if it were not for the hazard of flooding. The class III land is found along flood plain edges and upland terraces; the main uses are cropland, pastureland, and forest land. The class IV soils are on moderate slopes in the watershed and are used mainly as pastureland. Class VI soils are found on steeper slopes in the watershed and are used for pastureland and forest land. Class VII soils are found on the steepest slopes in the watershed and are almost entirely in forest land. There are no class VIII soils in the project area. The Cedar Run watershed is composed of the following land classes:

LAND USE BY LAND CAPABILITY CLASSES IN PROJECT AREA

Land Capability Class	% of Total in Each Class	Acres in Each Use				Total Class Acres
		Cropland	Pasture	Forest	Other	
I	3.82	217	1241	603	442	2,503
II	20.28	3393	5264	3755	877	13,289
III	37.89	6277	8068	7185	3291	24,821
IV	23.19	2564	5471	5655	1504	15,194
V						
VI	8.87	268	2000	3106	435	5,809
VII	5.95	38	943	2874	46	3,901
VIII						
Total Use Acres		12,757	22,987	23,178	6,595	65,517
% of Total In Each Land Use		19.47	35.09	35.38	10.06	100.00

Geology - The area drained by Cedar Run is underlain by igneous, metamorphic, and sedimentary rocks 1/. The Piedmont Physiographic Province in this area includes part of the Piedmont Upland and the Piedmont Lowland 2/. The boundary between these sections is a series of normal faults known as the Catoctin Mountain Border Fault. It separates Triassic rocks in the eastern part from Precambrian and Cambrian rocks in the western part.

The Precambrian rocks include the Catoctin Series and the Fauquier formation. These rocks include metamorphosed lava flows and dikes altered to greenstone of the Catoctin Series and biotite garnet gneiss and mica schist of the Fauquier Formation. The Cambrian Loudoun Formation is metamorphosed sediments forming arkosic quartzite and slate.

The Triassic rocks east of the faults are represented by the Newark Group of shales, sandstone, and baked shale adjacent to the diabase sills and dikes. The shales are red and olive with some interbedded reddish-gray sandstone. The sills of diabase cover large areas whereas the diabase dikes are generally smaller and finer grained. The main minerals present are feldspars (plagioclase-labradorite) with orthoclase and albite (accessory minerals) and pyroxene-augite. About 90 percent of the diabase is plagioclase and augite 3/.

Rocks west of the faults have a tendency to be deeply weathered with less weathering east of the faults. The soils are shallow over Triassic rocks both igneous and sedimentary. Much of the stream channel of Cedar Run is on or close to bedrock.

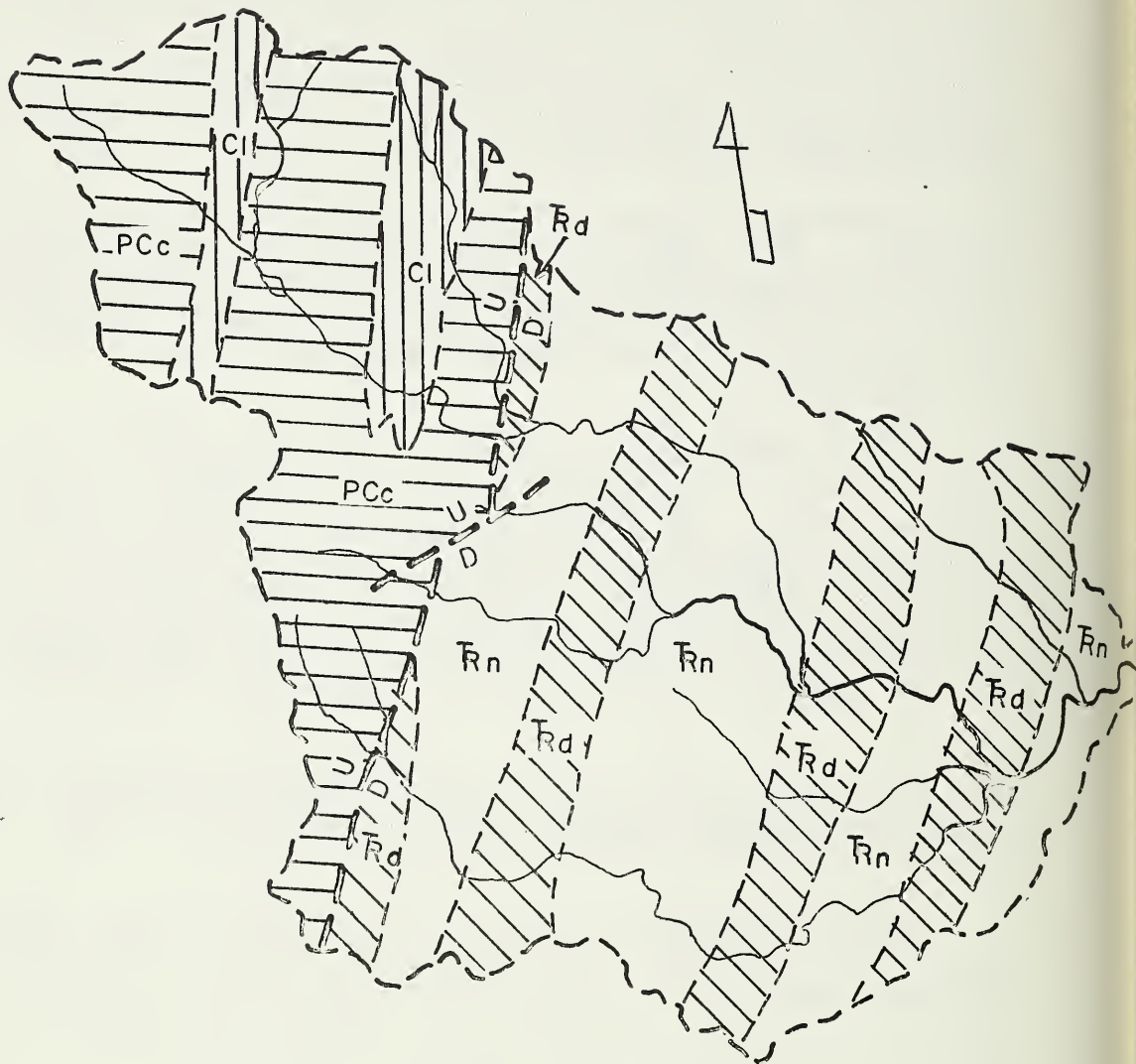
Mineral Resources 4/ Fauquier County (660 sq. mi.) is underlain by igneous, metamorphic, and sedimentary rocks. During 1970, diabase was quarried near Warrenton to obtain crushed stone for roads, concrete aggregate, and other uses. Quartzite was quarried east of The Plains in the Bull Run Mountain area and was marketed for flagstone, walls, and a variety of other building uses.

1/ A. S. Furcron, Geology and Mineral Resources of the Warrenton Quadrangle, Virginia Bul. 54 VGS, 1939.


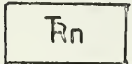
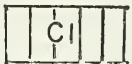
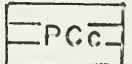
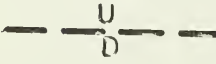
2/ N. M. Fenneman, Physiography of the Eastern United States, McGraw-Hill Book Co., Inc., 1938.

3/ J. K. Roberts, The Geology of the Virginia Triassic, Bul. 29 VGS, 1928.

4/ Data Summary - Fauquier County, Virginia, Division of State Planning and Community Affairs, January, 1972.



GENERALIZED GEOLOGIC MAP
CEDAR RUN WATERSHED

TRIASSIC		DIABASE SILLS & DIKES
TRIASSIC		NEWARK GROUP SHALE & SANDSTONE
CAMBRIAN		LOUDOUN FORMATION
PRE - CAMBRIAN		CATOCTIN SERIES & FAUQUIER FORMATION
		NORMAL FAULT (Approximate Location)

In the past, gold was mined and prospected intermittently at several sites in the vicinity of Morrisville, Sumerduck, and Goldvein. Copper minerals were prospected and mined in small quantity near High Knob in western Fauquier County, and occurrences near Bealeton and Elk Run have also been prospected. Barite has been mined at several localities near Catlett, Bristersburg, and Bealeton. Slate that occurs near Fauquier White Sulfur Springs was formerly quarried on a small scale for use as roofing shingles. Vein quartz has been quarried near Hume and Orlean and crushed for use as ornamental aggregate. Several other types of rock, including granite, metabasalt or greenstone, diabase, sandstone, and schist have been quarried in Fauquier County as sources of crushed stone and building stone. Limestone and marble have been quarried for use in local lime kilns.

Shale, siltstone, and mudstone occur in the eastern part of the county. These materials are potentially suitable for use in the manufacture of brick and tile. No significant deposits of fuel minerals are reported or known to be in the watershed.

Ground Water 1/ - All of Fauquier County is in the Piedmont Province except for the extreme northwestern part which is in the Blue Ridge Province. Igneous rocks consisting mainly of greenstone and granite underlie the northwestern part of the county. The central and southeastern parts of the county are underlain by igneous, metamorphic, and sedimentary rocks. The metamorphic rocks are mostly schists and the sedimentary rocks are principally red shales with some sandstones and conglomerates. Diabase intrusives occur within the sedimentary strata, and one fairly large mass of granitic rock is exposed in the southeastern part of the county.

The igneous and metamorphic rocks are typically low producers of ground water and the success of wells drilled in these formations is dependent upon encountering water-filled fractures usually within the first 250 feet. Yields are generally less than 30 gpm, although 50 gpm or more are not uncommon, and in a few cases yields exceeding 100 gpm have been obtained. The metamorphic rocks and the granites have relatively better potential for ground water than the other crystalline rocks.

Diabase rock, which is characteristically dense and impermeable, is an extremely poor source of water and should be avoided in development of ground-water supplies. Two wells drilled to depths exceeding 800 feet near Bealeton in 1971 were unsuccessful. The greenstone, which is widely exposed in the northwestern part of the county, is also generally nonproductive of ground water for other than small domestic needs.

1/ Data Summary - Fauquier County, Virginia, Division of State Planning and Community Affairs, January 1972.

The sedimentary rocks in the central part of the county offer the best potential for ground water. Yields of up to 50 gpm may be expected from these formations with properly developed wells.

Although certain areas of the county have better potential for ground water than others, on the basis of present information it is not possible to make reliable estimates of total groundwater availability per unit area.

Small supplies of water for domestic use are available from shallow, large-diameter wells constructed in the weathered zone of material that overlies the bedrock in most of the county. This weathered zone is usually 10 to 50 feet thick. Springs are numerous in the northwestern part of the county and have served a few public supplies and continue to provide water for domestic use.

Water from the igneous and metamorphic rocks is generally low in dissolved mineral matter, although a few cases of hard water have been reported. Iron content is likely to be high in some places, especially from the red shales.

Surface Water Resources - Cedar Run has its origin in the uppermost northwest corner of the project area. The first discernible perennial stream flow is in the middle elevations of the southern ridge of Rappahannock Mountain. The stream flows southeasterly to the Warrenton Reservoir, which is located about two miles north of the town of Warrenton. At approximately 0.6 miles north of State Route 670, Cedar Run is fed by Mill Run. At this juncture, Cedar Run is flowing easterly toward Auburn. Below Auburn, the stream follows a southerly course to its intersection with Turkey Run, at State Route 603 one mile north of the community of Calverton. Approximately 0.8 miles south of Catlett, Cedar Run is joined from the east by Owl and Licking Runs. From this point Cedar Run flows easterly to the Fauquier - Prince William boundary, which constitutes the end of this watershed project area.

East of the Fauquier County line and below the project area, Cedar Run is intersected by the combined branches of Elk, Negro, and Town Runs. In the Prince William County area of the total watershed, Cedar Run flows northeast to meet Broad Run to form Occoquan Creek. This common juncture is located 1.5 miles west of Lake Jackson and represents a combined drainage area of approximately 214,000 acres from the Broad Run and Cedar Run watersheds. Occoquan Creek flows generally easterly to the Occoquan Reservoir which is located north of the town of Occoquan in Prince William County. This reservoir is three miles above the mouth of the Occoquan tributary which feeds the Potomac River.

Cedar Run, from its origin on Rappahannock Mountain to Broad Run in Prince William County, is approximately 30 miles long. Over 20 miles of the principal branch of Cedar Run lies in Fauquier County which is in the watershed project area. The secondary branches of Cedar Run located in Fauquier County are Licking Run (13 miles in length), Turkey Run (12 miles), Mill Run (6 miles), Owl Run (5.5 miles), Walnut Branch (5.5 miles), and Gupton Run (4 miles).

Cedar Run provides drainage for the 102.37 square miles in the project area in the county and 195.6 square miles overall to the confluence with Broad Run. In relationship to the total Occoquan watershed, the Fauquier County project portion of Cedar Run provides drainage for approximately 17 percent of the contributing land area. Placed in the broader view of the entire Potomac River Basin, the project portion of the Cedar Run watershed represents 0.68 percent of the 15,000 square mile Basin and 1.79 percent of 5,700 square miles of the Basin which is located in Virginia.

Other perennial streams within the project area are as follows: an unnamed stream which passes through the two Airlie lakes, an unnamed stream that enters Cedar Run at the WEER radio tower, an unnamed stream northwest of and parallel to State Route 628 that enters Cedar Run from the south side, an unnamed stream flowing parallel to State Route 605 and 620, and an unnamed tributary crossing State Route 667. Numerous intermittent streams in the watershed enter Cedar Run along its entire length.

The principal existing surface water resources are located in the upper third of the watershed. The Warrenton Reservoir and the two lakes at Airlie are useful as water supply and private recreation respectively.

The town of Warrenton draws its water supply from the Warrenton Reservoir. The Airlie Lakes are located on a separate branch which flows into Cedar Run just above the Warrenton Reservoir. The Warrenton Reservoir plus four standby wells provide the only existing raw water supplies available to the town and its immediate service area.

With a surface area of 28 acres, the Warrenton Reservoir's capacity is 215 acre feet. Cedar Run in this area has a 10-year, 7-day low-flow of 0.019 cfs/mi².

The remainder of the watershed is scattered with farm ponds used primarily for livestock watering. There are an estimated 165 private ponds in the watershed, ranging from 1 to 3 acres in size.

Water in Occoquan Creek and its tributaries, including Cedar Run, above the Occoquan Reservoir which is now operated by the Fairfax County Water Authority, is classified as III-B by the Virginia State Water Control Board. According to standards adopted in 1970 ^{1/}, the "III" is the major class designation of "free flowing streams (coastal zone and Piedmont zone to the crest of the mountains)" and "B" is the subclass of "waters generally satisfactory for use as public or municipal water supply, primary contact recreation (prolonged intimate contact; considerable risk of ingestion), propagation of fish and other aquatic life, and other beneficial uses."

Land Use - Currently, 23,178 acres (35 percent) of the watershed is in forest land, 22,987 acres (35 percent) is in pastureland, 12,757 acres (20 percent) is in cropland, and about 6,595 acres (10 percent) is in other uses such as buildings, roads, utilities, and odd areas. This includes 100 acres of federal land owned by the U.S. Army.

Of the 23,178 acres in forest cover, 40 percent is in hardwoods consisting of white, red, black, chestnut, scarlet and pin oaks, along with yellow poplar, hickory, black gum, red maple, black locust, and black walnut. Mixed stands occupy 45 percent of the forested area and consist of Virginia and shortleaf pine in mixture with all the hardwood species already mentioned. Pure stands of Virginia, shortleaf, and loblolly pine occupy 15 percent of the forested area.

Current land use in the flood plain is mostly crops and pasture and the remainder is in hardwoods and other uses. The principal crops grown in these flood plains and surrounding uplands are corn, small grain, soybeans, and hay. Hardwood species include sweetgum, blackgum, ash, red maple, river birch, and winged elm. Understory vegetation includes honeysuckle, spicebush, wild grape, grasses, sedges, greenbrier, and wild onions. On the berm along the creek bank there is an occasional sycamore, willow, red or water oak, black-walnut, yellow poplar, ironwood, and bitternut hickory. The following tables give a detailed breakdown of flood plain land use by capability class for 4 specific locations.

There are no wetlands shown on the U.S. Geological Survey maps of the watershed. Likewise, an inventory of land uses within the

^{1/} Virginia State Water Control Board, 1970, Commonwealth of Virginia Water Quality Standards.

FLOOD PLAIN LAND USE BY CAPABILITY CLASSES

Unprotected - above structures

Land Capability Class	% of Total in Each Class	Acres in Each Use				Total Acres
		Cropland	Pasture	Forest	Other	
II	9	18	61	69	11	159
III	71	145	484	545	83	1,257
IV	20	41	136	154	23	354
Total Acres		204	681	768	117	1,770
Percent of Total in Each Land Use		11.5	38.5	43.4	6.6	100.0

Unprotected tributaries

Land Capability Class	% of Total in Each Class	Acres in Each Use				Total Acres
		Cropland	Pasture	Forest	Other	
II	12	20	66	34	9	129
III	63	103	349	176	48	676
IV	25	41	139	70	19	269
Total Acres		164	554	280	76	1,074
Percent of Total in Each Land Use		15.2	51.6	26.1	7.1	100.0

FLOOD PLAIN LAND USE BY CAPABILITY CLASSES

Protected

Land Capability Class	: % of Total : in : Each Class	Acres in Each Use				: Total : Acres
		Cropland	Pasture	Forest	Other	
II	11	59	159	72	35	325
III	68	361	979	436	231	2,007
IV	21	111	303	134	71	619
Total Acres		531	1,441	642	337	2,951
Percent of Total in Each Land Use		18.0	48.8	21.8	11.4	100.0

Protected - below project area

(Reach Q and part of Reach M)

Land Capability Class	: % of Total : in : Each Class	Acres in Each Use				: Total : Acres
		Cropland	Pasture	Forest	Other	
II	11	19	30	43	79	171
III	67	114	186	259	481	1,040
IV	22	38	61	85	157	341
Total Acres		171	277	387	717	1,552
Percent of Total in Each Land Use		11.0	17.9	24.9	46.2	100.0

watershed plus detailed survey work at each proposed site failed to locate any wetlands as classified in accordance with "Wetland of the United States", U.S. Department of the Interior, U.S. Fish and Wildlife Service Circular 39.

There are over 100 small springs and hillside seeps throughout the watershed that maintain small wet areas and provide water for terrestrial wildlife and habitat for frogs and other amphibians and reptiles. Some of the larger springs have been developed for home and livestock use. Significant springs are located on the soil survey maps. Most of the springs and seeps are in pasture or forest land where they are maintained in herbaceous vegetation.

Such areas in pastureland often have an occasional clump of juncus, along with water tolerant grasses and sedges. In forest land, such wet spots are likely to support red maple, alder, and willow.

PRESENT AND PROJECTED POPULATION

According to the U.S. Bureau of the Census 1/, the 1970 population of Fauquier County was 26,375; of which 4,027 resided in the town of Warrenton. The county's population remained relatively stable, at about 21,000 to 21,500 from 1920 to 1950 1/. Since that time it has grown at the rate of about 1 percent per year.

Even though the Cedar Run watershed represents only about 15.5 percent of the county land area, it contains almost one-third of the total population. Based on the county's land use and development plans, the population ratio in the watershed is expected to increase somewhat over the next 20 to 25 years. The project area accounted for 32 to 42 percent of the county's increase in population in 1970, 1971, 1972, and 1973 2/.

Several population projections have been made for Fauquier County by consultants in connection with various studies of needs for public utilities and county planning activities. Projected population growth rates and levels represent a wide range, from an annual growth rate for the period 1980 and 2000 of about 1.6 percent projected by the Virginia Division of State Planning and Community Affairs, to 10.7 percent per year projected by Metcalf and Eddy in the 1969 report 3/. As an indication of the rate of population increase in the project area, compared to Fauquier County and Warrenton during 1970, 1971, 1972, and 1973 a total of 1,293 building permits were issued 2/, of which 526 (40.7 percent) were in

1/ U.S. Bureau of the Census: Population 1920, 1930, 1940, 1950, 1960, and 1970.

2/ Rosser H. Payne, Jr. and Associates - Planning Consultants.

3/ Metcalf and Eddy, Comprehensive Pollution Abatement Plan for the Occoquan Watershed, 1969.

the Cedar Run watershed. The growth ratio is expected to continue in the 32 to 34 percent range until the service districts now planned by the county are fully developed. This will encourage population centers which can be efficiently serviced with water and sewer services and other necessary utilities, and at the same time retain relatively large areas of the county in a rural environment.

ECONOMIC RESOURCES

Most of the Cedar Run watershed is privately owned. Federal land in the watershed consists of approximately 100 acres of the Warren-ton Training Center, operated by the U.S. Department of the Army. Other public lands consist of narrow strips needed for highway rights-of-way and small areas owned by the county for schools and other public needs.

According to the 1969 Census of Agriculture, 89 percent of the farm income in Fauquier County was from the sale of livestock, poultry, and their products; 7.8 percent from the sale of grain and field seed crops; 0.9 percent from sale of forest products; and 2.3 percent from sale of nursery stock and miscellaneous field crops.

The major agricultural enterprises in the Cedar Run project area are dairy and beef farms and the breeding and training of thoroughbred horses. Presently forest stands occupy an estimated 35 percent of the watershed area. There is a good demand for quality hardwood sawtimber and veneer logs at sawmills within Fauquier County and at concentration yards and sawmills in adjoining counties. Pine pulpwood is also in demand; a good market outlet is a short distance outside the watershed at Bealton, about 2.5 miles southwest of Midland. Hardwood pulpwood can sometimes be marketed, although demand is light and the market varies greatly with changing economic conditions.

There are 275 farms in the watershed, ranging from less than 10 acres for some of the smaller part-time operations to 1,625 acres for the largest unit. The average size is about 215 acres.

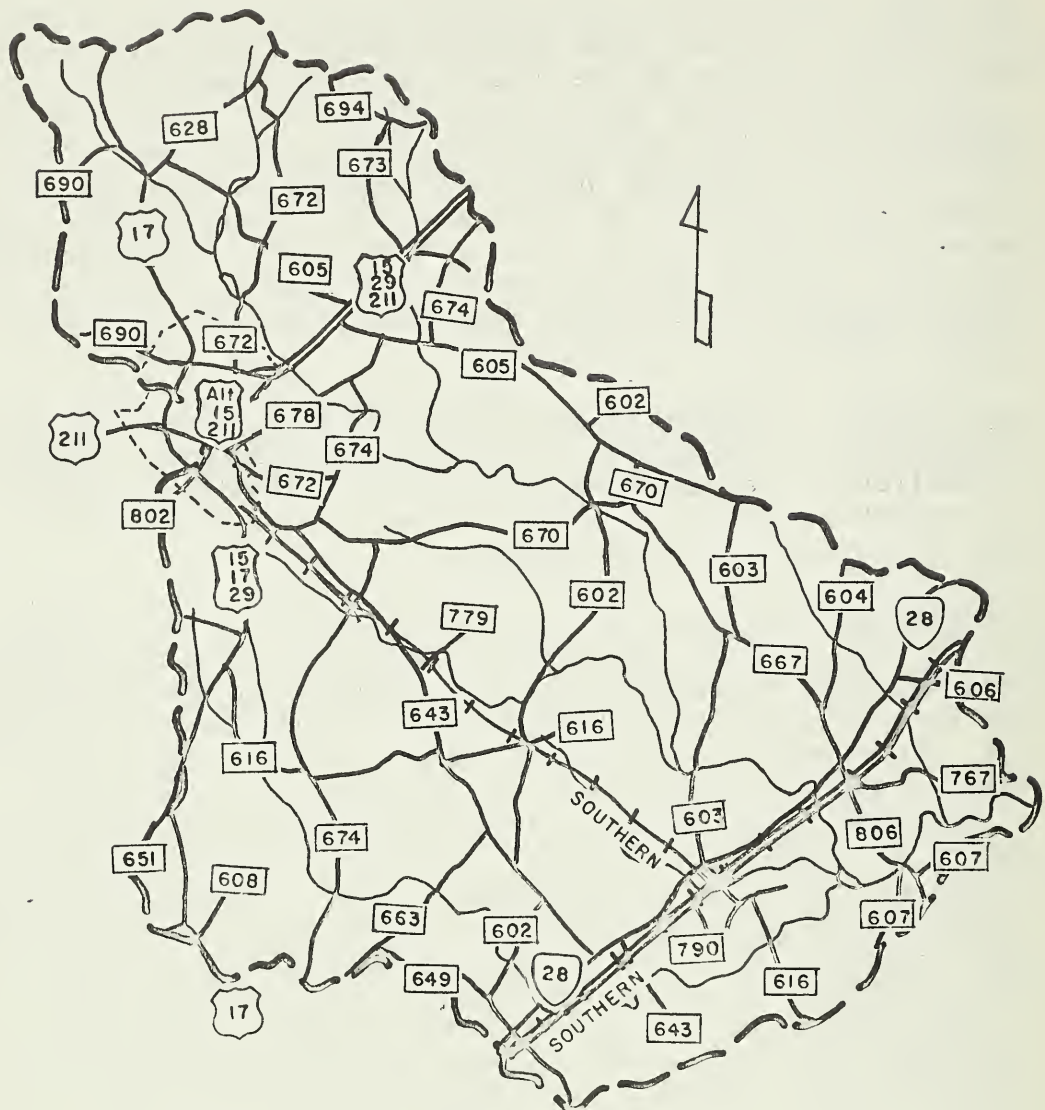
Production levels for crops grown in the watershed reflect the flood hazard and the necessity of using marginal upland for some crops. Current production levels per acre are 60 to 90 bushels of corn, 42 to 50 bushels of barley, 1.5 to 3.0 tons of hay, 10 to 18 tons of silage, and 17 to 22 bushels of soybeans. Pasture provides 2 to 8 animal-unit-months of grazing per acre. With the existing flood hazard, the bottom-land soils average about 80 bushels of corn, 45 bushels of barley, 15 tons of silage, 2.5 tons of hay, and 20 bushels of soybeans, with pasture providing 6 animal-unit-months of grazing.

The major forest types in the watershed are presently 40 percent hardwoods, 45 percent mixed hardwood and pine, and 15 percent pine. Twenty-seven percent of the stands are of sawtimber size with a volume of 1,500 board feet or more per acre; 33 percent of the stands are pole size with a volume of 500 or more cubic feet per acre; with the remaining 40 percent seedling and sapling size trees. Income from production of lumber and other forest products contributes significantly to the local economy. Given adequate protection from fire, insects, and disease and given proper management, the forest stands will contribute even more to the future overall economy of the watershed.

Land values, exclusive of buildings, currently range from \$750 to \$3,000 per acre depending on location, accessibility, availability of utilities, use, and development costs. Flood plain land values are usually estimated at about \$750 per acre when included as a part of tracts with usable upland.

The watershed is served by four Federal highways, U.S. Highways 15, 17, 29, and 211 which intersect at Warrenton. See the transportation map. Highways 29 and 211 coincide to form a multilane divided highway from Warrenton to Washington, D.C. To the west of Warrenton, U.S. 211 provides access to the Skyline Drive in the Shenandoah National Park and to U.S. 11 and Interstate 81 at New Market. South of Warrenton, U.S. 29 serves as a major thoroughfare between Washington, D.C. and Atlanta, Georgia. U.S. 15 is a major highway between Rochester, New York, and Savannah, Georgia. Virginia Highway 28 passes through Catlett, Calverton, and Midland, providing access to the Washington, D.C. area to the northeast and U.S. 29 and 15 to the southwest. A network of secondary roads provides easy access to all parts of the watershed. Motor freight transportation is available daily throughout the area with connections to all parts of the nation. Trailways Bus Lines maintains daily schedules between Washington, D.C. and Charlottesville, Virginia, and has a ticket office at Warrenton. The Warrenton-Fauquier Airport at Midland has two paved runways, 2,800 feet and 4,200 feet long, suitable for small planes. The nearest commercial airline service is at Dulles International Airport, about 22 miles to the northeast and at Washington National Airport about 35 miles to the east. Rail freight service is provided by the Southern Railway at Warrenton, Catlett, Calverton and Midland.

Income in Fauquier County was \$2,779 per capita in 1960, almost 1.5 times the average for Virginia. However, the 1970 census reported an average income per capita for Fauquier County of \$2,756, a median income per capita of \$2,264. The county is located along the southwest border of the Washington, D.C., Standard Metropolitan Statistical Area. In 1960, 18.6 percent of the county's work force was employed in the Washington area. This is the source of much of the above-average income. Even with these nearby opportunities for employment, the 1970 census reports approximately 15 percent of the families in the county had an income of less than \$3,000.



TRANSPORTATION SYSTEMS CEDAR RUN WATERSHED

Fig. 7

The 1969 Census of Agriculture reports 27.2 percent of the farms in Fauquier County with less than \$5,000 in gross sales. Farm ownership by operators increased from 64 percent in 1964 to 68.2 percent in 1969. During this period the proportion of part-owners decreased from 27.5 percent to 23.7 percent and tenant-operated farms increased from 5 to 8 percent. In 1969, 85.8 percent of the farms were classified as individual or family farms; 11.8 percent as partnerships; 1.4 percent as corporations, including family owned; and the remaining 1.0 percent as "other" types of ownership such as institutional, research, reservations, etc. The civilian work force has constituted approximately one-third of the total population since 1960, during which time unemployment has ranged from 4.6 to 4.9 percent.

Of the 275 farms 72 are classified as part-time operations and 25 as part-retirement farms, with the remaining 178 being full-time operations. A part-time farm operation is described in the U.S. Census of Agriculture as one in which annual gross sales were less than \$2,500 and the operator was under 65 years of age and worked more than 100 days off-farm during the census year. A part-retirement farm is described as one in which the value of farm products sold was less than \$2,500 and the operator was 65 years of age or older.

Most of the farms are single family, owner-operated units, with day-labor hired as needed. Several of the larger operations employ both day-labor and full-time employees who live on the farm. With access to the Washington, D.C. metropolitan area becoming increasingly easy, the number of part-time farm operations is expected to increase as the area urbanizes in the direction of Fauquier County and off-farm employment opportunities improve.

Electricity and telephone service are available to all parts of the watershed. Solid waste disposal facilities are provided by Fauquier County with a centrally located sanitary landfill. Sewage treatment facilities are being planned with the use of a regional facility designed for tertiary treatment in accordance with State Water Control Board criteria for the Occoquan Watershed of which Cedar Run is a part. A public water system planned for the communities in the watershed is designed to use the impoundments as a source of supply. These utilities will be reviewed on a continuing basis and expanded as the need develops.

PLANT AND ANIMAL AND RECREATIONAL RESOURCES

Cedar Run watershed supports a wide variety of plant communities. Currently, 23,178 acres are in forest land, 12,757 acres are in cropland, 22,987 acres are in pastureland, and approximately 6,595 acres are in other uses such as homes, yards, odd areas, buildings, roads, and utilities. Plant communities such as annual plants, grasses and legumes, shrubs, hardwoods, and coniferous trees provide elements of wildlife habitat. Terrestrial wildlife habitat is based on the quality and quantity of the plant communities. This watershed has a variety of plant communities in various stages of succession. The 12,757 acres of cropland are well distributed throughout the watershed. It provides a variety of plants including annual weedy plants, grain, and seed crops, and a variety of grasses and legumes for hay.

Annuals require bare soil on which to become established and grow. They develop seed in great abundance, and most of the seeds are durable and long lived. Therefore, annual plants provide valuable wildlife food. The most valuable wildlife food among the cultivated annuals is corn, followed closely by wheat, milo, oats, and soybeans. Among the wild annuals which provide food are barnyard grass, lambs-quarter, ragweed, foxtail, pigweed, chickweed, and smartweed. Approximately 350 acres are idle each year and provide ground cover and some weed seed for wildlife food.

Characteristic wildlife species of open land are blackbirds, meadowlarks, mourning doves, sparrows, and finches. Other species of wildlife which use open, cultivated, or weedy areas, but which depend on a mixture of vegetative types, are bobwhite quail, cottontail rabbits, gray fox, shrews, and meadowmice.

Grasses and legumes planted for hay are a very important element of wildlife habitat. They provide nesting and contrasting types of dense, low wildlife cover and furnish food for a wide variety of mammals and birds in particular situations. There are a very few spots in the watershed where grasses represent the climax vegetative community. Therefore, whether natural or planted, grasses and legumes make up a very unstable and short-term plant community unless well cared for.

Practically all grasses and legumes used for pasture have some value for erosion control and wildlife. Fescue, bluestem, and orchardgrass provide nesting areas for field sparrows, meadowlarks, bobwhite quail, cottontail rabbits, meadowmice, and short-tailed shrews. These, as well as whitetail deer, wild turkeys, and groundhogs feed on the tender growth of a wide variety of grasses and legumes as well as the associated small seeds and insects. Grass and legume areas are more valuable and useable to wildlife if woody vegetation is nearby.

Within the watershed, shrubs become a component of the plant community during the ecological process of succession. This is a natural process which is continuously attempting to take place after man-made or agronomic communities are substituted for the natural forest. The shrubs occur in the intermediate, unstable community of annuals and mixed herbaceous perennial plants. Shrubs also are an element of tree communities, forming distinct layers in forest lands. Usually, different shrub species are found in these two situations..

In the shrub stages of plant succession, there is considerable variation in the ability of different species to maintain themselves. Some, such as dewberry, blackberry, and raspberry have a relatively short period of dominance. They are eventually replaced by honeysuckle, sumac, elders, hazelnut, and other species which are intermediate in span of dominance. Flowering dogwood, hawthorn, and redbud are late-stage plants that persist in abundance even after trees have become dominant. Shrubs seem to fall in successional categories, as follows:

<u>Early Stages</u>	<u>Mid Stages</u>	<u>Late Stages</u>
dewberry	hazelnut	flowering dogwood
blackberry	poison ivy	hawthorn
raspberry	sumac	redbud
blueberry	honeysuckle	spicebush
huckleberry	elder	shadbush

Many forms of wildlife in the watershed find the shrubs a valuable source of food and cover. Included are the whitetail deer, ruffed grouse, bobwhite quail, woodchucks, jays, thrashers, robins, cardinals, and cedar waxwings.

Trees occupy the final stage of plant succession in this watershed. They have a high degree of stability, and major changes are relatively slow unless the forest cover is disrupted by man's activities such as logging, burning, or grazing. Trees which provide dens, nest sites, seeds, fruits, buds, and nuts are valuable for a wide variety of wildlife species. The eastern red cedar and loblolly, shortleaf, and Virginia pines provide habitat for thrushes, pine warblers, whitetail deer, gray squirrel, eastern chipmunk, mice, and cottontail rabbits. Mixtures of conifers and hardwoods such as oaks, hickory, black walnut, holly, wild cherry, and ash are more valuable to wildlife than pure stands of any single tree species. Wildlife associated with the mixed coniferous and hardwood forest are ruffed grouse, whitetail deer, opossum, raccoon, gray fox, gray squirrel, brown thrasher, cardinal, woodpecker, wood thrush and red-eyed vireo. See Appendix E for lists of flora and fauna commonly found in the watershed.

Cedar Run and its tributaries are typically small, warm water, poor quality fishing streams. They contain low populations of large-mouth bass, bluegill, pumpkinseed and green sunfish, suckers, and yellow bullheads. Stream surveys with an electro-shocker did indicate a fair to good population of redbreast sunfish on the lower portion of most tributaries, although the fish were generally under five inches in length. One of the reasons for the poor quality of fishing on Cedar Run and its tributaries is the low flow during the late summer months. Surface Water Records of Virginia showed no discharge in Cedar Run at the Catlett gage on the following dates:

1954	Sept. 19-Oct. 15	<u>1/</u>	1963	Aug. 7-19	<u>2/</u>
1957	Aug. 12-Aug. 24			Sept. 18-28	
1959	Aug. 19-30 & Sept. 17-30			Oct. 13-20	
			1964	Sept. 11-19	
			1966	July 27-Aug. 11	
				Aug. 26-Sept. 13	

These discharge records on Cedar Run near Catlett measure the discharge from 93.5 square miles of drainage area. Licking Run, Mill Run, Turkey Run, Owl Run, and Gupton Run, tributary streams on which five of the proposed reservoir sites are located, are small and do not support a significant fishery 3/. For a complete list of all fish collected, including non-game species, see Appendix E.

Stream bottoms in Cedar Run are sand mixed with silt, combined with gravel and bedrock in sections traversing diabase sills and dikes. Approximately 60 percent of the water areas in the streams are well shaded. Benthic organisms were collected over all types of bottom materials and were found to be varied and diversified. They included water spiders, fresh water snails, muscles, crayfish, and 29 genera of aquatic insects in 22 different families. Aquatic insects such as mayflies, stoneflies, and caddisflies indicate good water quality, capable of producing and sustaining higher forms of aquatic life. Reptiles and amphibians such as bullfrogs, water snakes, salamanders, and snapping turtles have been observed. Refer to Appendix E for a listing of biota.

Fishing pressure on the streams is moderate with a low frequency of angler success. There are several public access sites to the Rappahannock River within 10 miles of the southern border of the watershed. This river is one of the last prime smallmouth bass habitats on the East Coast. Lake Brittle, a state-owned impoundment

1/ Surface Water Supply of Virginia, Bulletin numbers 16 and 24, Commonwealth of Virginia, Department of Conservation and Economic Development, Division of Water Resources.

2/ Water Resource Data for Virginia, USDI, Geological Survey.

3/ U.S. Fish and Wildlife Service biological reconnaissance of the Cedar Run Watershed - typed letter to Tom F. McGourin, State Conservationist, Soil Conservation Service, dated May 5, 1971.

of 77 acres, is located within 10 miles of Warrenton to the northeast of the Cedar Run watershed boundary. It is stocked with bass, sunfish, and other warm-water species. With fair to moderate success, fishing pressure is extreme during the summer due to the proximity of the Washington Metropolitan area. It appears that nearby Lake Brittle is already being fished to the limits of its biological productivity. Thompson Lake, also state owned, is six acres in size and offers some fishing, but it is not stocked and management is at a minimum.

Farm ponds provide considerable fishing for the owners and their guests, and attract waterfowl as a side benefit. During the waterfowl spring and fall migrations, species observed are mallard, black and wood ducks with an occasional Canada goose. Wild mallards occasionally nest in grassy areas around farm ponds, and wood ducks will use hollow trees or nest boxes when available. Other than the 165-odd farm ponds and reservoirs in the watershed, suitable waterfowl habitat is virtually absent.

Vegetative cover for wildlife in this watershed consists of forests, pasture, abandoned fields, and crops. This interspersed cover types provides a large amount of edge effect, which produces excellent habitat for farm wildlife such as deer, rabbits, quail, and song birds. The best squirrel and wild turkey habitat is found in the northern end of the county where big estates have protected extensive stands of large, old mast trees. Woodchuck, raccoon, opossum, mourning dove, ruffed grouse, and red fox populations are moderate to good and fairly evenly distributed throughout the area.

Part of the watershed lies within the boundaries of a regularly scheduled fox hunt. Deer harvest is slightly less than one per square mile. Approximately 70 turkeys are taken yearly out of the 660 square mile county. Bobwhite quail hunting success is above average for the state. There is very little trapping for fur in the county. Beaver are found in most streams and bobcats are on the increase. The eastern cottontail rabbit population has been spotty for the last three to four years. However, opossums are now estimated at close to 1,000,000 animals county-wide. Both spotted and striped skunks are found in the watershed.

Cedar Run, which is less than 50 miles from the Washington Metropolitan area, is located where there are no large facilities for public outdoor recreation. Most of the land is posted, and access is limited to local residents who are granted written permission on a day-to-day basis.

The level of local, state, and federal sponsored outdoor recreational activities in Fauquier County is considered to be inadequate by the

Virginia Commission on Outdoor Recreation. The present inventory of public owned and operated recreation developments in the Cedar Run watershed and Fauquier County indicates that they are nonexistent.

The only outdoor recreational area worthy of mention within the watershed is the Airlie Estate, which is a private foundation for the sole use of the guests at the conference center. It provides tennis and swimming facilities, riding stables, and an extensive game preserve for its clientele.

There are no known threatened plant or animal species in the Cedar Run project area.

ARCHEOLOGICAL, HISTORICAL, AND UNIQUE SCENIC RESOURCES

A careful check and review of the National Register of Historic Places was conducted; no listing was found for the watershed area. The Virginia Historic Landmarks Commission was consulted and they made a map study and conducted an investigation and the following information on places of historic interest was given:

Weston - originally built in 1773, but with later Gothic-period additions (currently known as Melrose Castle Farm and located about one mile southeast of site 1 and 1/2 mile east of Casanova).

Neavil's Mill - Located at Auburn, originally a colonial inn was located near this mill. The hostelry had George Washington as guest on his way to survey land for Lord Fairfax. The mill has recently been restored and registered as a state historical site.

Daniel's Mill - located on Cedar Run about 2 miles east of Catlett.

The state archeologist was consulted and he stated "I have searched my files and find no record of archeological sites in the area involved in the project. From my previous knowledge of the area and from a detailed study of the USGS Topographical Maps, I am confident that there are no significant archeological remains in the affected area." 1/

The National Park Service was notified with respect to the project in compliance with the National Historic Preservation Act of 1966 (80 Stat. 915) and Public Law 93-291, 93rd Congress S. 514, 1974.

The scenic values of the watershed are those of a pleasant rural environment, typified by low rolling hills covered by deciduous and mixed pine forest, interspersed by crop and pasture land.

1/ Letter from State Archeologist, March 4, 1975.

Fauquier County's well kept horse farms and fine horses attract nationwide attention. There are numerous hunt clubs, polo clubs, and other equestrian organizations located in the county. The famed Virginia Gold Cup race meet has been held annually in Warrenton since 1922. Lying along the northwestern ridge line of the watershed northeast of Rappahannock Mountain is Wildcat Mountain. It is a 633-acre natural area owned by a private non-profit group known as The Nature Conservancy. The mountain is an unspoiled eastern deciduous forest and has a wide range of animal life common to the area.

SOIL, WATER, AND PLANT MANAGEMENT STATUS

Beef and dairy operations, and the breeding and training of thoroughbreds and other horses have been the principal industries in the county for the last 50 years. The county ranks fourth in the state in the sale of livestock and dairy products, and first in thoroughbreds.

Urban development is encroaching on agricultural land in the watershed. Presently, this pressure is most pronounced in the Warrenton, Catlett, and Calverton areas. This trend is expected to continue. Future land use will show a gradual shift of the marginal cropland into pasture or nonagricultural uses. The remaining, more productive, cropland will be more intensively farmed to meet the demand for corn, wheat, soybeans, and other food crops.

Flood plain lands are potentially the most productive and have the least erosion hazard of any area in the watershed, when not subject to flooding. Even with the present flood hazard, almost 45 percent of the flood plain is used for pasture, with another 15 percent used for cropland to provide the on-farm feed and forage needs. Approximately two acres of upland cropland is needed to provide the production obtained from one acre of bottom land protected from flooding.

The John Marshall Soil and Water Conservation District provides land use and treatment assistance to landowners and operators in Fauquier County. It also reviews land use plans and developers' site plans for land use changes, as related to the Fauquier County erosion and sediment control ordinance. Technical assistance is provided to developers to meet the requirements of the ordinance.

This district has been very active in promoting conservation land treatment in all areas. One hundred twenty-eight operators have developed conservation plans for their entire units, and 21 are in the process of developing complete plans. Fifty-four percent of the 275 farms encompassing 60 percent of the project area have cooperative agreements with the John Marshall Soil and Water Conservation District.

Land cover conditions are good to fair, with small scattered areas on some farms in need of special conservation practices. Approximately 80 percent of the practices planned have been installed. The agricultural practices applied include pasture and hayland management, pasture and hayland planting, minimum tillage, ponds for livestock water, tree planting, and other similar measures. Corn is the principal crop on the 10,025 acres of cropland. Minimum tillage is used on 80 percent of the acreage planted to corn. See Appendix D for a description of these measures. Adequate treatment practices have been applied to 10,025 acres of cropland, 12,300 acres of pastureland, and 14,978 acres of forest land.

None of the flood plain land can be managed to produce to its full potential because of the flood hazard. Seventy-five percent of the flood plain is inundated at about two-year intervals, and about half of the flood plain area is flooded one or more times a year. About 35 percent of the flood plain has been abandoned for use as cropland or pasture because of the flood hazard.

PROJECTS OF OTHER AGENCIES

The Warrenton, Virginia water supply reservoir, a 28-acre lake with 215 acre-feet of storage capacity, is located on Cedar Run just downstream from site No. 3. Two other reservoirs are located on the Occoquan River downstream from the Cedar Run project area. One of the reservoirs, Lake Jackson, is located just upstream from Highway No. 234, and is a recreation lake owned by Prince William County and the Country Club Lake Corporation. The Occoquan Reservoir is located just upstream from the town of Occoquan and is a water supply impoundment owned by the Fairfax County Water Authority.

Long range plans for Fauquier County call for the establishment of five water service districts which will provide service to Warrenton and other major population centers within the county. Present plans are to utilize the water resources of the Cedar Run watershed to provide service to four of these districts. The Airlie site 3 will be owned and operated by the town of Warrenton as a part of their existing water supply system. The existing water treatment plant and distribution system will require upgrading to meet the increased demand. The other two sites (#4 and #6) will be owned and operated by Fauquier County. A new water treatment plant will be located at each of the two county-owned sites. New distribution systems will also be required to supply major population centers adjacent to the two sites.

The results of water quality tests conducted by the Virginia State Water Control Board indicate that conventional treatment processes should be effective in treating the water of Cedar Run. Water at the Warrenton treatment plant is presently being treated by the addition of chemicals, coagulation, filtration, chlorination, and fluoridation.

To meet current and future needs, the present water treatment plant at Warrenton will need to be updated to approximately one million gallons per day, and the Auburn treatment plant should have an initial capacity of about 1.5 mgd in order to supply the total projected needs for the Warrenton and New Baltimore service districts through 1985. The Licking Run treatment plant should have an initial capacity of about 1.0 mgd to supply the projected needs of the Catlett-Calverton and Remington-Midland service districts for the same time period.

The present water distribution system including storage tanks, pumping stations, and water mains will be updated for the town of Warrenton, and similar systems will need to be installed for the areas served by the two Fauquier County sites. The lines will be sized for adequate fire flow as well as maximum domestic demand resulting from future growth within the service districts. The spacing of fire hydrants will be based on recommendations of the National Board of Fire Underwriters.

Fauquier County has a grading, soil erosion and sedimentation ordinance which requires approval of plans and specifications in order to clear, fill or grade land in the county. The county also has a zoning ordinance which prohibits building below the 100-year flood line.

There are no other existing or proposed projects of other agencies within or outside the watershed which would be affected by the proposed works of improvement in this plan.

WATER AND RELATED LAND RESOURCE PROBLEMS

LAND AND WATER MANAGEMENT

Until the late 1930's, gully and sheet erosion resulting from overgrazing of pastures, lack of conservation measures on cropland, and poor harvesting practices on forest land were major problems in this watershed. Up to 75 tons of sediment per acre were lost from the steep headwater areas, with lesser amounts lost on the moderate slopes downstream. In recent years this situation has been largely overcome with development of overall land use planning and the increased installation of land treatment measures by landowners and operators. There is still need for land treatment measures throughout the watershed in order to utilize the land to its best potential. These needed adjustments appear to be within the financial capability of the landowners, with the assistance available through current conservation programs. Measures needed include practices such as those contained in Appendix D. A continuing effort is being made to encourage more widespread application of conservation measures by landowners and operators. Providing technical assistance to landowners to establish needed land treatment measures will be a major factor in the installation of an overall watershed management program. This will be especially true as areas undergo major changes from agricultural land use to urban developments.

FLOODWATER DAMAGE

Runoff from storms of the 5-year frequency magnitude block road approaches to seven bridges in the watershed, and the 100-year frequency storm runoff blocks 15 roads. Flows from large storms also carry debris, silt, and other contaminants which cause various problems. Weed seeds are deposited on pasture and cropland fields, increasing farm operating costs, and health hazards often arise when deposits from flood flows are left on flood plain areas and road crossings. Flood-blocked roads cause economic losses to residents from either long detours to market or loss of income because places of employment cannot be reached.

The water supply reservoir and intake for the Warrenton water system are located in Reach S (see project map), and are affected by both high and low flows in the upper reaches of Cedar Run. The functioning of this utility is affected by storm flows of the 10-year storm and larger; sometimes requiring quick emergency action to prevent serious damage to pumping facilities and equipment.

The most damaging storm in recent years occurred in June 1972. It produced stages at some locations exceeding those expected from a storm occurring once in 100 years, and caused an estimated \$295,000 in direct physical damage to flood plain impoundments and agricultural interests. Other serious storms occurred in August 1940,



Fig. 8 Flooding Cedar Run - March 1968

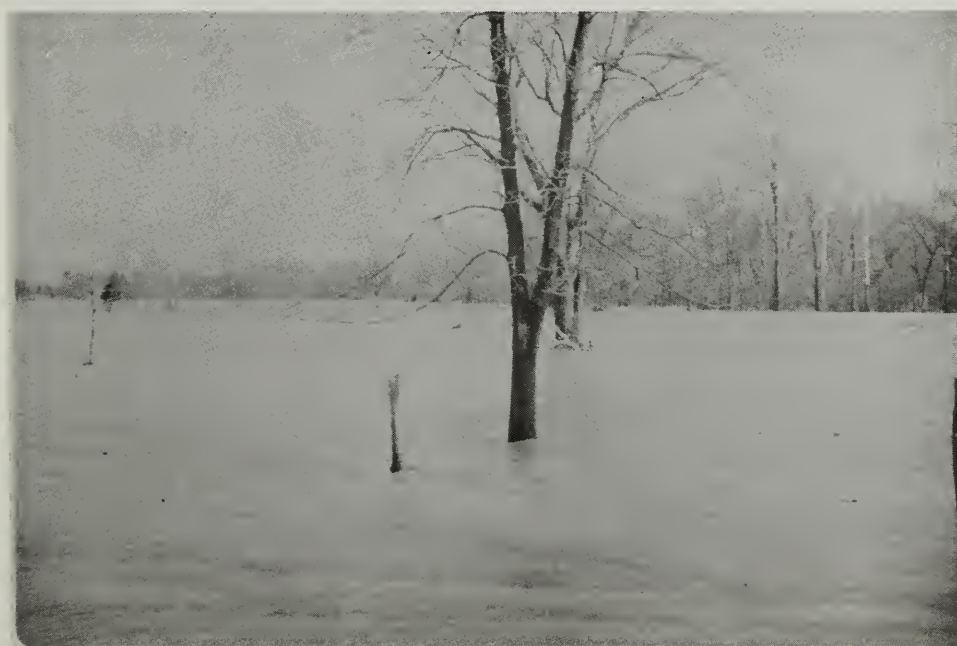


Fig. 9 Cedar Run Flood Plain - March 1968



Fig. 10 Route 806 Flooding of Cedar Run
from Hurricane Agnes - June 1972



Fig. 11 Flood Damage from Hurricane Agnes
June 1972 - by Route 806 at Cedar Run



Fig. 12 Flood Damage from Hurricane Agnes
June 1972 - Route 651 at Marsh Run
Fauquier County



Fig. 13 Flood Plain Flooding from Hurricane Agnes
June 1972 - Carter's Run - Fauquier County



June 1942, December 1950, November 1953, June 1955, March 1962, January 1964, February 1965, March 1967, February 1971, and April 1973. The most damaging floods often occur following high-intensity, short-duration rainfall from storms of tropical origin. These storms give little warning of their approach and move through the area quickly causing rapid development of flood flows. The Triassic soils in this watershed are generally shallow to rock and exhibit high runoff characteristics during intense storms.

The 100-year frequency storm runoff inundates 4,503 acres below proposed structure sites on Cedar Run and its tributaries, with over 82 percent of this area inundated by the 5-year frequency storm runoff and over 76 percent by the 2-year runoff. At the present time, none of the agricultural flood plain land can be managed to produce to its potential. As more of the land in the county is developed for nonagricultural use, the flood plain areas will become more important for cropland and pasture use. Average annual damages to crops and pasture are estimated at \$13,450. Landowners generally agree that flood-free production on one acre of flood plain land is at least equal to the production from two acres of upland.

Existing minor agricultural improvements located in the flood plain consist chiefly of fences, private roads, a few ponds and small structures, all of which vary in their susceptibility to damage. The average annual damages to these improvements amount to \$64,940.

There are 3.75 miles of public roads and 16 bridges in the area affected by this project. Some of these roads are blocked annually by floodwater from one to three hours. The runoff from the 100-year frequency storm blocks all the roads in the area for 1 to 15 hours, causing serious traffic problems and income loss to the residents. Average annual damages to these improvements amount to \$8,690, exclusive of loss of income, cost of rerouting, and traffic delays.

Other improvements subject to damage include 9 rural homes, 17 barns and other farm buildings, one commercial property and the Warrenton water system intake, treatment plant, and pumping station. Neavil's Mill near Auburn and Daniel's Mill located near the downstream end of Reach M are properties of local historic interest. (See project map.) Damages to these improvements are estimated to be \$15,440 annually.

EROSION DAMAGE

Erosion on upland areas has been a serious problem in the past due to erosive soil types and insufficient application of conservation measures by landowners and operators. Among several factors contributing to this were untreated road banks, sheet erosion on cropland,

overgrazing of pastures, inadequate protection during development of land for nonagricultural uses, poor overall hydrological condition of forest land, and poor logging practices in harvesting forest products. In recent years, increased application of conservation measures on farm land, seeding of road banks, and a local erosion and sediment control ordinance have greatly reduced this problem.

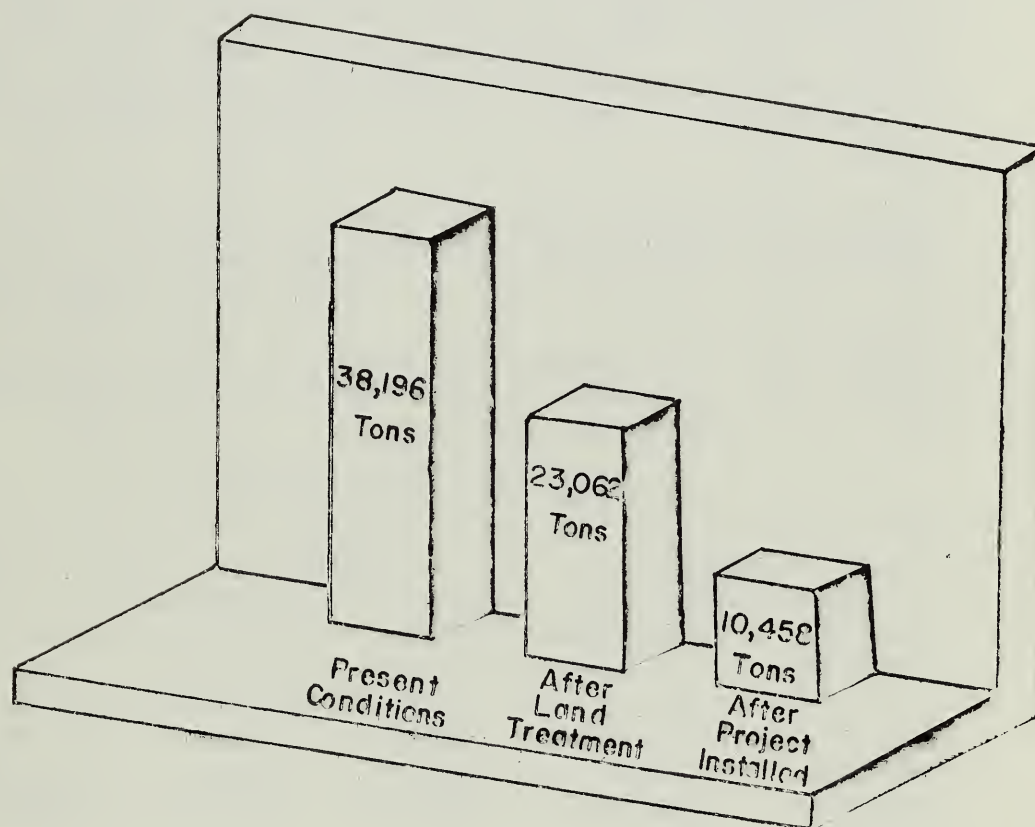
The necessity for using upland areas instead of flood plain land for cultivated crops complicates this problem. Sheet erosion on upland cropland, as computed by Soil Conservation Service procedures, is about 20.07 tons per acre per year, and estimated values for other uses show an average on all land of about 5.83 tons per acre per year. The cropland producing the greatest amount of sediment in the watershed is the 6,277 acres in land capability class III, the 2,564 acres in class IV, and 3,393 acres in class II. Erosion rates from untreated road cuts and fills can exceed 75 tons per acre per year.

SEDIMENT DAMAGE

Frequent flooding leaves deposits of fine-grained sediment over rather large areas, and coarser materials at localized areas of the flood plain. These coarse, infertile deposits damage the land and reduce production and income for the landowners. The finer sediment deposited over large areas causes less damage to productivity. The damage survey conducted indicates that over-wash and scour damages on Cedar Run were not serious enough to warrant monetary evaluation.

Sediment deposition from flood flows on roads and bridges causes added clean-up and maintenance costs and creates a safety hazard to motorists. Difficulties in vehicle control occasionally result in serious accidents. Deposits of sediment from floods reduce bridge and channel capacities and lower storage capacity of reservoirs. Suspended sediment also lowers water quality for municipal and industrial uses, recreation, fish habitat, fishery potential, recreational boating, esthetic values, and other possible future uses.

The area above the proposed site #3 will contribute 3,867 tons of sediment per year. A large percentage of this sediment would be deposited in the Warrenton Reservoir which is located less than a mile below the proposed site #3. The damages are estimated to be \$16,880 per year. The Warrenton Reservoir is owned and operated by the town of Warrenton and supplies municipal and industrial water to Warrenton and parts of Fauquier County. Sediment from Cedar Run causes downstream damages to Occoquan Creek, Lake Jackson, and the Occoquan Reservoir. It is estimated that Cedar Run delivers approximately 38,196 tons per year to Occoquan Creek. No attempt was made to evaluate these damages.



SEDIMENT FROM CEDAR RUN
REACHING OCCOQUAN CREEK ANNUALLY

Fig. 14

MUNICIPAL AND INDUSTRIAL WATER PROBLEMS

At the present time, a public water system owned and operated by Warrenton furnishes water to the town and adjacent areas of Fauquier County. The Warrenton reservoir has a drainage area of about 12 square miles, a surface area of 28 acres, and a total storage volume of 215 acre-feet. Water released from this impoundment flows downstream to a water treatment plant with a rated capacity of 0.5 mgd, where it is treated with chemicals, coagulated, filtered, chlorinated, and fluoridated. In addition to the surface supply, four drilled wells are included in the system. Two of these wells have a yield of approximately 30 gpm; the third well yields 300 gpm and the fourth well yields 750 gpm. The water from one of these wells is fluoridated. Storage facilities in the town system consist of a 23,000-gallon clear well at the water treatment facility, an elevated tank of 500,000-gallon capacity, and an enclosed steel tank of 2.5 million gallons.

The town of Remington also has a municipally-owned system. One drilled well equipped with a 50 gpm pump delivers water to a 150,000-gallon steel standpipe, and then to the distribution system. A county-owned system at Paris obtains its supply from springs and a drilled well. The springs discharge to a 35,000-gallon concrete storage tank. The well is equipped with a 20 gpm pump which delivers water to a 3,000-gallon hydropneumatic storage tank.

A privately-owned system at Marshall furnishes water from two wells, each of which is equipped with treatment facilities for the removal of iron and manganese. The treated water is pumped to the distribution system with the excess going to a 25,000-gallon concrete stand tank. A privately-owned system at The Plains provides partially chlorinated and softened well water to a portion of the town. There are several privately-owned water systems which furnish untreated well water to subdivisions within the county. There are also two federally-owned water systems within the county. Another privately-owned water system has recently been developed at Bealeton to serve a mobile home park.

All of Fauquier County lies in the Piedmont Province except for the extreme northwestern part which is in the Blue Ridge Province. The area drained by the Cedar Run watershed is underlain by igneous, metamorphic, and sedimentary rocks. The western third is underlain by the Catoctin series and the Loudoun formation, neither of which is considered an important source of ground water.

The eastern two-thirds of the watershed is underlain by younger rocks of Triassic age. The Newark formation composed of shale and sandstone lies east of the Catoctin border fault which is east of

Warrenton and runs in a north-northeast direction. Triassic diabase occurs as sills and dikes injected into the Newark sediments. The diabase is considered a poor source of water and while water is generally plentiful in the sandstone and shale, it is generally hard.

In general, the older geologic formations found in the Piedmont Province have poorer aquifer characteristics than are found to the east towards the Coastal Plain. The feasibility of developing and maintaining permanent public ground water supplies in the Piedmont (including the Cedar Run watershed) is not good.

Fauquier County is adjacent to the rapidly-urbanizing Prince William County, a portion of the Washington, D.C. Standard Metropolitan Statistical Area. Approximately 20 percent of the people living within the watershed boundary are employed outside of the county, because of the strong urban influence within one hour's driving time. Orderly development of the county will require the addition of surface storage and expansion of existing water treatment and distribution systems. The consultants retained by the county recommend participation in the P.L. 566 project as the most desirable means to provide facilities needed for the service-district concept of controlled growth in the county.

The following table shows the future water needs of the four service districts to be supplied by the Cedar Run structures:

Total Municipal Water Requirements
(million gallons per day)

<u>Planning District</u>	<u>1985</u>		<u>2000</u>	
	<u>Population Served</u>	<u>Total Needs</u>	<u>Population Served</u>	<u>Total Needs</u>
Warrenton	7,800	1.155	61,000	10.078
New Baltimore	8,100	1.310	14,400	3.056
Catlett-Calverton	3,600	0.523	17,000	3.240
Remington-Midland	<u>3,000</u>	<u>0.435</u>	<u>25,000</u>	<u>3.960</u>
TOTALS	22,500	3.423	117,400	20.334

Domestic demand is based on 100 gpcd for 1985 and 120 gpcd for 2000. Commercial demand is based on 1,000 gallon per acre (233 acres total) in 1985 and 2,000 gallons per acre (547 acres total) in 2000.

Industrial demand is based on 2,000 gallons per acre (445 acres total) in 1985 and 5,000 gallons per acre (1030 acres total) in 2000.

All of the above projections are based on the 1967 Comprehensive Plan as described in the consultant's report.

RECREATION AND PLANT AND ANIMAL PROBLEMS

It is apparent that Fauquier County will be strained to achieve a full recreational program to meet the internal growth demands. An additional burden can be expected to be incurred from the regional population, particularly Northern Virginia, where the recreational activity demand is growing twice as fast as the population. The population of the Northern Virginia area east of Fauquier County will have grown to 1.3 million by 1980 and 1.7 million by 1990. It is reasonable to expect a significant spillover into the county for hunting and fishing uses, though an accurate estimate would be difficult to ascertain. Most of the land is posted, and access is limited to local residents and friends granted permission by the landowner on a day-to-day or seasonal basis.

Hunting presents a real problem in the Cedar Run watershed. Since the majority of the land remains productive agriculturally, farmers are reluctant to have hunters infringe upon their beef and dairy stock and horse pasture areas for game purposes. It is hard to accommodate safe hunting in tracts of less than 300-500 acres. Most private tracts are of this size or less and are posted for the reasons stated above. At present, there are no expansive public hunting areas in the watershed. The Quantico U.S. Marine Corps base in the southern tip of the county is not really designed or managed as a public recreation area. However, extensive areas of the base have been opened to public hunting and considerable seasonal use is made of the property. Many Fauquier residents participate in the annually scheduled fox hunts within the county. Private hunt clubs arrange these hunts on local farms, hunting with horses and dogs without objection from the landowners.

The 1967 Fauquier County Comprehensive Plan projected that the county's ultimate (year 2000) parkland requirements for recreation facilities would be 18,000 acres, based on the standards established by the Virginia Outdoor Recreation Study Commission. In 1972 the Fauquier County-Warrenton Parks and Recreation Study Commission was created by the Board of Supervisors to plan for the county's recreation needs. Through the actions of this commission, plans have been formulated to develop two of the P.L. 566 multiple-purpose impoundments as county parks, offering various water-based recreation opportunities. Within the project area, the only developed recreational area, excluding county school playgrounds, is the complex at Airlie Estates. This is a private facility for the use of guests at the conference center.

Cedar Run and its tributaries are typical warm-water fisheries, their poor quality is due in part to the extended periods of low flow experienced annually. There are several public access sites to the

Rappahannock River within 10 miles of the project area. This river offers good fishing, being one of the prime natural smallmouth bass habitats on the east coast. Lake Brittle, a 77-acre state-owned impoundment located to the northeast of the project area, represents the only stocked public fishing facility in the county. Anglers have fair to moderate success in this stocked lake, but fishing pressure is extreme during the summer months.

A list of the common plant and animal species found in Fauquier County has been compiled and is included as Appendix E. There are no threatened species resident within the project area. Current and projected land use changes from agriculture to urban uses are altering the landscape patterns and consequently claiming wildlife habitat areas.

WATER QUALITY PROBLEMS

Water quality in Cedar Run and its tributaries is considered to be good in relation to that found in the remainder of the Occoquan Creek Watershed. Water in the Occoquan Creek and its tributaries, including Cedar Run, above the old Alexandria Water Company's water supply impoundment, now operated by the Fairfax County Water Authority, is classified as III-B by the Virginia State Water Control Board. According to standards adopted in 1974 ^{1/}, the "III" is a major class designation "free flowing streams (coastal zone and Piedmont zone to the crest of the mountains)" and the "B" is a subclass for "waters generally satisfactory for use as public or municipal water supply, primary contact recreation (prolonged intimate contact; considerable risk of ingestion), propagation of fish and other aquatic life, and other beneficial uses."

The Environmental Protection Agency's Water Quality Storet System ^{2/} gives existing water quality results for the watershed area, based on data accumulated prior to July 1974. (See Appendix G).

Water quality examinations in the watershed were performed in June 1974 by the State Water Control Board ^{3/}. (See Appendix G.) Water samples were taken at each of the seven P.L. 566 watershed impoundment locations. The chemical concentrations appeared to be constant throughout Cedar Run and its tributaries. The temperature range in the various streams was between 68 and 80 degrees Fahrenheit June 10, 1974 and between 72 and 83 degrees Fahrenheit August 15, 1974 with the highest temperature being experienced in Owl and Licking

^{1/} Virginia State Water Control Board, 1974, Commonwealth of Virginia Water Quality Standards.

^{2/} Storet data, Information Systems and Analysis Branch of the Environmental Protection Agency.

^{3/} Bureaus of Surveillance and Field Studies of the Commonwealth of Virginia State Water Control Board.

Runs, and the lowest in Cedar Run at Airlie. All of the samples tested had normal seasonal temperatures with the cited variations attributable to the geographic location of the streams within the watershed. Test results for sample No. 1 which is one of the sites selected for water supply (site 3) indicated a high coliform count in the June 1974 report; however, the coliform count for a subsequent test sample No. 1 made in August 1975 is well within the required limits for domestic consumption. All other parameters in the August series of tests were similar to those in the June testing. The town of Warrenton has been informed of these tests and recognizes that a problem may exist.

As urbanization increases the reservoirs are planned to provide for reduced stream sedimentation from erosion, to recharge ground water, and to protect flood plain areas which would otherwise adversely impact streamflow quality during periods of peak runoff. There is one major sewage treatment plant in the watershed with its effluent going into the Rappahannock River; only three commercial establishments deposit secondary treated effluent into Cedar Run or its tributaries. Overall, the water is of high quality in relation to its recreational or esthetic values. The streams above sites 3, 4, and 6 will be continually monitored and will meet the Virginia State Health Department requirements prior to and during their use for public water supply facilities. This responsibility will be borne by the appropriate sponsor.

ECONOMIC AND SOCIAL PROBLEMS

The 1969 Census of Agriculture indicates that 35.8 percent of the farms in Fauquier County are classified as part-time or part-retirement farms with gross sales of less than \$3,000. A review of watershed information indicates that about 27 percent of the operations had less than \$5,000 annual income. About 15 percent of these farms are classified as part-time or part-retirement. There are 105 farms in the watershed which use 1-1/2, or more, man-years of hired labor.

The 1970 census indicated an average per capita income of \$2,756 and a mean income per family of \$8,627 for the area compared with an average for the state of \$3,012 and \$10,568. This indicates the average per capita income of approximately 91 percent of the state average compared to 116 percent in 1950 and 1965. The census data also indicates that approximately 80 percent of the homes had complete bathroom facilities and about 84 percent had complete kitchen plumbing facilities. The state average was 88.6 percent and 91.3 percent respectively.

These facts indicate the need for development of all local resources to aid in more effective use of available labor resources to improve family income and living standards. Development of the land and water resources in the area will produce conditions which encourage economic growth and rural area development, and will result in improved family life styles and a better overall place to live.

RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

This plan has been developed in accordance with existing Federal, State, and local land use plans, policies, and controls. Particular attention has been given to the Federal Water Pollution Control Act Amendments of 1972. One of the major objectives of the plan is to reduce erosion on the watershed, and thereby reduce stream pollution from this source. The project will also aid in reducing sedimentation in the Warrenton, Lake Jackson and Occoquan reservoirs, and downstream in the navigable channels of the Potomac River and Chesapeake Bay.

The Rappahannock-Rapidan Planning District Commission, which includes Fauquier County, is in the process of developing long-range resource plans for the area. Control of floodwater and sediment, and an adequate municipal and industrial water supply are major concerns in the region's resource and development plans. Surface storage in Cedar Run is an integral component of the planned service district utilities water supply plan now being developed for Fauquier County. Other features of the watershed plan will serve as resource planning tools for the Planning District Commission, the county, and town of Warrenton planning commissions for long-range planning, zoning, and development of the areas' resources.

Fauquier County has zoning ordinances which prevent building in the 100-year flood plain. They also have a sediment control ordinance which requires approval of plans and specifications in order to clear, fill or grade land in the county. These ordinances are compatible with proposed project.

ENVIRONMENTAL IMPACT

CONSERVATION LAND TREATMENT

Approximately 22,946 acres of watershed land will be affected by the application of accelerated conservation land treatment measures. Approximately 45 percent of the watershed has already benefited by application of conservation land treatment measures under the going program. More are expected to benefit during project installation. Both vegetative and structural types of land treatment measures will effectively retard runoff, conserve soil moisture, prevent excessive loss of topsoil on 275 farms, and help control erosion on nonagricultural development.

Land treatment will help restore and maintain soil productivity by adding or holding plant nutrients. It will reduce soil losses on cropland and pastureland to tolerable limits of 4 tons or less per acre per year so that, in the future, a suitable soil profile will be available to grow plants for a sustained and indefinite period. Soil losses on forest land will be reduced to less than 2 tons per acre per year. The county ordinance to control erosion and sediment requires developers to prepare site plans prior to construction which include land treatment measures to control erosion on their project site.

Land treatment measures will reduce runoff on an annual basis, as indicated from studies conducted by the Agricultural Research Service 1/, from 28 to 56 percent depending upon the practices installed. Studies conducted by the Extension Division of Virginia Polytechnic Institute and State University 2/ show that no-tillage planting can result in 80 - 90 percent less runoff.

Where appropriate, land use changes will be made. Pollution of surface waters by pollutants attached to soil particles will be greatly reduced by reducing erosion.

Conservation land treatment will be installed on 4,550 acres of cropland, 8,200 acres of pastureland, 420 acres of other land, and 9,776 acres of forest land. Land treatment measures include 150 acres of wildlife upland habitat management.

A resource management system is a group of interrelated conservation practices or land treatment measures and management techniques applied to a given resource such as cropland, forest land, or pastureland for specified functions or uses such as timber, forage, hay and

1/ Agricultural Research Service, Technical Bulletin 1281, USDA Runoff and Erosion Control Studies on Cecil Soil in the Southern Piedmont.

2/ Virginia Polytechnic Institute and State University, Publication 419, No-Tillage Machinery and Seedbed Requirements.

crop production; improvement of fish and wildlife habitat; improvement of water quality; and improvement of esthetics in the watershed. See Appendix D. Many of the measures will enable landowners to more fully utilize sound resource management systems to increase efficiency and volume of production. Planned land treatment measures are estimated to reduce the gross erosion rate from 5.8 to 3.5 tons per acre per year.

Land treatment measures will reduce the amount of sediment reaching the Warrenton reservoir by an estimated 162 tons, and will reduce the amount of sediment leaving the watershed by about 15,134 tons annually. The sediment from Cedar Run contributes to the total load in Occoquan Creek. Therefore, reducing the volume of sediment will lessen downstream damages to municipal and industrial water supplies, fish habitat, recreational areas, and esthetics. Soil surveys and other resource inventories and evaluations will provide basic information needed by landowners planning land use changes and improved resource management systems.

STRUCTURAL MEASURES

Installation of the proposed structural measures will require that the land use be either changed or restricted on a total of 1,421 acres. On the areas to be inundated by the sediment and water supply pools are 382 acres of pasture and 104 acres of forest and other uses. The flood detention pools, which will only be flooded occasionally, contain 45 acres of cropland, 458 acres of pastureland, and 169 acres of forest and other uses. The emergency spillway storage areas contain 10 acres of cropland, 104 acres of pastureland, and 39 acres of forest and other uses. The construction areas will occupy what is now 99 acres of pastureland and 11 acres of forest and other uses. The proposed structures will inundate approximately 7.7 miles of perennial streams, which is about 7.5 percent of the perennial streams in the watershed.

The 2,000 acre-feet of municipal and industrial water storage will provide the projected needs for four of the five service districts in accordance with the Comprehensive Plan adopted by Fauquier County in 1967. This will provide a high quality water source for economic growth and development of the county, reducing the migration of families from rural to urban areas by providing local employment opportunities. During prolonged drought periods there may be exposure of up to 93 acres from drawdown of water supply pools.

Protection of the flood plain will allow the farm operators and other landowners to manage their operations more efficiently on about 3,013 of the 4,503 acres of protected flood plain. There will be a reduction in average annual damages of approximately 66 percent. A total of 113 landowners will receive flood prevention

benefits as a result of the project. The area flooded by the 100-year frequency storm will be reduced by 710 acres, the 10-year storm by 862 acres, the 5-year storm by 1,076 acres, and the 2-year storm by 1,283 acres. Four hundred and fifty-eight acres of protected flood plain will be converted from forest land to cropland and pasture.

The structures will trap 3,723 acre-feet of sediment during their 100-year design life. This amount, when combined with the reduction in sheet erosion due to land treatment of the watershed area not controlled by structures will reduce downstream damages from this source by an estimated 39 percent. The amount of sediment leaving the Cedar Run watershed will be reduced by 27,738 tons annually. Reduction in the amount of sediment deposited in downstream channels and reservoirs will improve the quality of water for human consumption, and will also improve conditions for fish and wildlife. Site 3 will trap 3,480 tons per year preventing this sediment from being deposited in the Warrenton Reservoir and will substantially eliminate the adverse effects of high and low flows on the operation of the water treatment plant.

Turbidity is expected to increase at times at each of the seven sites during construction. The rate is then expected to drop sharply below present conditions after construction is completed and land treatment measures are installed. Insofar as it is reasonably possible construction activities will be scheduled so that turbidity is not increased during the first spawning season.

New fisheries will be established at structures 4 and 6, with a minimum of 179 acres and a maximum of 248 acres for the two pools combined. A total of 7.3 miles of new shoreline will be created at the two sites, and 3.5 miles of perennial stream will be inundated. The streams affected contain low populations of game fish, and are subject to practically no fishing pressure. The two new lakes will be stocked with largemouth bass, bluegill and redear sunfish, and channel catfish. Recreational opportunities for lake fishing are expected to result in 20,000 visits per year. This will result in an increase in vehicular traffic, noise, fire hazard, solid waste, and litter.

An estimated winter breeding population of three deer, one wild turkey, 10 gray squirrels, and an unknown number of cottontail rabbits and other small animals will be displaced from 104 acres of forest wildlife habitat and 382 acres of pasture which will become pool areas. The overall carrying capacity for these animals will be reduced by loss of 1.7 percent of the total pasture and 0.5 percent of the total forest in the watershed. Some species of fish such as dace, fallfish, and various darters and shiners will decrease in the reservoirs while other species such as largemouth bass, pickerel, sunfish, and catfish will increase in population (see fish species under Appendix E for a complete list). Inundation of the flood detention pool areas will temporarily displace terrestrial species, but at the same time protect these same species in the flood plain below the structures.

Construction of the dams will require the clearing of 72 acres of forest land in the permanent pool areas, and the clearing and grubbing of another 146 acres in the permanent pool and construction areas. This forest land consists of stands of cut-over hardwood and brush. The hardwoods provide habitat for many animals including squirrels and songbirds, and the cut-over areas provide some habitat for deer, rabbits, quail, and other small nongame animals. The 672 acres in the flood detention pools, which are about 25 percent wooded, will only be flooded occasionally. While wildlife habitat patterns will be disrupted during flooding, flow-age easements will protect these areas of wildlife habitat from future development. There are no known threatened plant or animal species within the watershed.

The gates to be installed near the bottom of the risers on all structures will serve the purpose of water flow management. These gates will also provide the necessary means for releasing downstream flows in compliance with Virginia law. Additional storage will be provided in the three water supply sites to provide a guaranteed release rate equal to the 10-year, 7-day low flow (0.067 cfs for #3, 0.305 cfs for #4, and 0.615 cfs for #6). The purpose of this additional storage is to offset the effects of diverting water for municipal and industrial uses.

The installation of structure No. 6 will result in the displacement of one family, and one secondary state highway (No. 602) may be slightly affected where it crosses the left abutment. The same secondary state highway (602) may either require raising or relocation where it crosses the right abutment of structure No. 1. Two secondary state highways (Nos. 605 and 674), in the extreme upper reaches of the flood pool of structure No. 7, will be flooded approximately once in 25 years. Fauquier County will secure a permit from the State Department of Highways and Transportation to temporarily close these roads. The county will be responsible for giving notice and posting warnings to motorists. Authority for closing is granted in the Code of Virginia, Section 33.1-223.2, as amended.

FISH SPECIES KNOWN IN CEDAR RUN PROJECT AREA
AND EXPECTED POPULATION CHANGES IN THE IMPOUNDMENT AREAS

<u>Common Name</u>	<u>Scientific Name</u>	<u>Expected Impact</u>
Redfin pickerel	<i>Esox americanus</i>	S+
Rosyside dace	<i>Clinostomus funduloides</i>	E
Cutlips minnow	<i>Exoglossum maxilllingua</i>	E
River chub	<i>Nocomis micropogon</i>	E
Golden shiner	<i>Notemigonus crysoleucas</i>	S+
Comely shiner	<i>Notropis amoenus</i>	E
Satinfin shiner	<i>N. analostanus</i>	S+
Common shiner	<i>N. cornutus</i>	S or E
Spottail shiner	<i>N. hudsonius</i>	S or S+
Swallowtail shiner	<i>N. procne</i>	S or E
Rosyface shiner	<i>N. rubellus</i>	E
Bluntnose minnow	<i>Pimephales notatus</i>	S+
Blacknose dace	<i>Rhinichthys atratulus</i>	E
Fallfish	<i>Semotilus corporalis</i>	E
White sucker	<i>Catostomus commersoni</i>	S+
Creek chubsucker	<i>Erimyzon oblongus</i>	E
Northern hog sucker	<i>Hypentelium nigricans</i>	S
Yellow bullhead	<i>Ictalurus natalis</i>	S+
Brown bullhead	<i>I. nebulosus</i>	S+
Margined madtom	<i>Noturus insignis</i>	E
Redbreast sunfish	<i>Lepomis auritus</i>	S or S+
Green sunfish	<i>L. cyanellus</i>	S or S+
Pumpkinseed	<i>L. gibbosus</i>	S+
Bluegill	<i>L. macrochirus</i>	S+
Hybrid sunfish	<i>L. hybrids</i>	S or S+
Smallmouth bass	<i>Micropterus dolomieu</i>	S or E
Largemouth bass	<i>M. salmoides</i>	S+
Fantail darter	<i>Etheostoma flabellare</i>	E
Tessellated darter	<i>E. olmstedii</i>	E
Shield darter	<i>Percina peltata</i>	E

S = Survival; S+ = Possible Expansion

E = Extinction or severe reduction within impoundment

ECONOMIC AND SOCIAL

The comprehensive land and water resources plan proposed for the Cedar Run watershed will provide conditions which will allow more efficient land use, enhance the local economy, improve scenic values, and aid in improving local living standards.

The primary objectives of this project--to implement a land treatment program which will effectively control erosion and resulting sedimentation from development of uplands, provide a minimum of 2-year frequency protection to at least 50 percent of the flood plain in the benefited area, and protection of existing highways in the watershed from significant damage from the 100-year frequency event--will be realized. Land use changes resulting in agricultural uses, and other adjustments consistent with overall development plans, will allow a higher level of management for 3,013 acres of agricultural flood plain land and provide guidelines and information for the orderly development of the area. Use of such practices as improved crop varieties, more timely planting, cultivating, and harvesting of crops; increasing production of forage and grain crops; and producing crops for food will improve both farm income potential and the quantity and quality of food available to meet local and regional needs. Increased agricultural production and other economic activities will improve both farm and off-farm employment opportunities for an undetermined number of presently underemployed workers.

Expansion of a public water system in this area will provide municipal and industrial water in an area which is undergoing development pressure from the Washington, D.C. metropolitan area of economic influence.

A committee familiar with local conditions determined that installation of this project will aid in maintaining a sound local tax base by protecting flood plain improvements, providing facilities and technical information necessary for the planned land use changes and other features of the development and use of the area's resources.

Traffic interruptions from flood-blocked roads will be virtually eliminated for the 8,575 people now living in the watershed, the 6,000 to 8,000 new residents expected within the next 20 years, and the many thousands of travelers who use the highways daily.

Homes with complete kitchen plumbing facilities are expected to increase from 84 percent in 1970 to 95 percent; and those with flush toilets will increase from 80 percent in 1970 to 95 percent in the next 20 years. The state average for these items in 1970 was 88.6 and 91.3 respectively.

Unemployment has averaged 4.6 to 4.9 percent of the work force since 1960. Even though the 1970 mean income per family of \$8,627 was over 81 percent of the state average, about one-third of the families had incomes of \$3,000 or less. In 1970, the average per capita income was 91.5 percent of the state average, compared to 116 percent in 1950 and 1966. This would indicate significant underemployment of a segment of the area's available labor force. Development of this project will provide a water supply necessary for an increase in local commercial and industrial operations. This will increase employment opportunities and income levels for an undetermined number of residents who are presently underemployed or unemployed, resulting in improvements to regional and national production and income.

Installation of the project will provide an estimated 100 man-years of employment. Ten permanent semi-skilled jobs are anticipated after project completion in connection with the utilization, operation and maintenance of project features. Property values will increase near the bodies of water and areas benefiting from flood protection, thereby increasing the tax base.

Benefits from this project will extend beyond the project area boundary. Damages and damage reduction evaluations were made on the flood plain of Cedar Run from the project boundary to the confluence of Cedar Run and Town Run. Damages will also be reduced downstream from this point on Cedar Run, and to a lesser extent on Occoquan Creek. In addition to reduction of floodwater damages, sedimentation will be reduced in Lake Jackson, the Occoquan water supply reservoir, and the navigable channels of the Potomac River and Chesapeake Bay. However, no attempt was made to evaluate monetary benefits beyond the confluence of Cedar Run and Town Run.

INTERNATIONAL IMPACTS

Multiple-purpose structure site number 3 is located on the Airlie property near Warrenton. This property, known as Airlie House and Farm, is an international conference center where up to 200 guests may live, work, and relax in conditions which provide the best possible atmosphere for their deliberations.

Installation of the planned project measures will serve as an example to visitors from other nations of the application of modern planning techniques and environmental considerations in the orderly development of land and water resources in small watersheds.

FAVORABLE ENVIRONMENTAL EFFECTS

- a. Reduce average annual damages by approximately 66 percent
- b. Reduce sediment leaving the watershed by about 27,738 tons annually due to land treatment, trapped sediment, and land use changes
- c. Reduce erosion, retard runoff, improve wildlife habitat, and enhance the esthetic values of the watershed through land treatment measures on 22,946 acres
- d. Provide an estimated 20,000 annual recreation visits by creation of 248 acres available for public fishing at sites 4 and 6
- e. Create 486 acres of warm water fisheries and habitat for waterfowl and other aquatic life
- f. Create approximately 100 man-years of employment during construction and 10 permanent jobs
- g. Increase farm income and production by allowing more efficient and effective use of about 3,013 acres of flood plain land
- h. Provide high-quality water sources
- i. Reduce downstream sediment damage to the Warrenton Reservoir, Lake Jackson, and Occoquan Reservoir
- j. Improve living conditions in the area by controlling floodwaters
- k. Improve 150 acres of managed wildlife upland habitat
- l. Reduce gross erosion rates from 5.8 tons per acre per year to 3.5 tons per acre per year
- m. Provide water storage allowance for flow management at the Auburn site 6 and Licking Run site 4
- n. Improve conditions for planned urban development through adequate municipal and industrial water storage
- o. Increase property values near bodies of water and areas benefiting from flood protection, thereby increasing the tax base

ADVERSE ENVIRONMENTAL EFFECTS

- a. Inundate approximately 7.7 miles of perennial stream which is about 7.5 percent of the perennial streams in the watershed
- b. Inundate or restrict use of 1,421 acres presently in cropland, pastureland, and forest and other uses
- c. Increase turbidity at times during construction period
- d. Increase in vehicular traffic, noise, fire hazard, solid waste and litter as a consequence of increased human activity in and near the recreation areas
- e. Inundate 104 acres (0.5 percent) of forest wildlife habitat and 382 acres (1.7 percent) of pastureland
- f. Expose up to 93 acres from drawdown for water supply during prolonged drought
- g. Relocate a residence
- h. Convert 458 acres of forest wildlife habitat in the protected flood plain to cropland and pasture

ALTERNATIVES

ACCELERATED LAND TREATMENT ONLY

This alternative would provide technical assistance to keep conservation and forest land management plans up-to-date, to develop new plans as land ownership or land use changes, to maintain existing adequate cover, and to maintain installed land treatment. It would involve applying the needed conservation practices identified and described in the Planned Project section under Land Treatment Measures. The total cost of this alternative would be \$799,580 including the cost of maintaining the going conservation program.

The effectiveness of this alternative in reducing soil erosion and sedimentation should be essentially the same as for land treatment measures in the proposed project. Improved water infiltration into the soil due to land treatment measures would not have a noticeable effect on a storm of a 10-year frequency or greater. Floodwater damage reduction attributable to this alternative is estimated to be 9 percent.

This alternative would essentially meet the sponsors' objectives related to land treatment but flood damages would continue to occur to agricultural areas, historic sites, businesses, roads and bridges, and other flood plain improvements. The water supply objectives of the sponsors would not be met. There would be a net increase in cultivated crops on upland areas with this alternative. Urban growth of the area could not be accomplished as desired by the sponsors because of an inadequate water supply.

Another effect of this alternative would be that recreation needs of the area would remain unsatisfied. The facilities for an estimated 20,000 recreation visits annually would not be provided.

The 1,268 acres of land involved in the structures and pool areas, as proposed in the planned project, would remain as crop, pasture, and forest land with incidental wildlife uses. Wildlife food and cover would be furnished from field borders, scattered areas of wildlife plantings, and residual grains remaining after harvest. Almost 8 miles of perennial stream would be retained. The temporary increase in turbidity during construction of the dams would not occur. Some of the adverse environmental effects of the planned project would be avoided. Likewise, some of the beneficial effects would be precluded.

NONSTRUCTURAL ALTERNATIVE

Accelerated Land Treatment with Acquisition of Flood Plain Land and Flood Plain Properties - This alternative would include the benefits and impacts of the accelerated land treatment alternative. Acquisition

of the 100-year flood plain and flood plain properties would include the purchase of approximately 5,795 acres including: 9 houses, 9 barns, 9 miscellaneous buildings, and 1 historic mill which are subject to flooding. These purchases would cost about \$7,000,000.

The removal of commercial and agricultural operations from the flood plain would eliminate the present physical damages to these interests. Damages to roads, bridges, and utilities would continue. Farm operating costs would increase, jeopardizing the farmers' competitive positions and increasing their dependence on off-farm income. In some instances, purchase of the flood plain would create inefficient units which would not permit the continuation of farm or business operations at their existing locations. This would require the purchase of entire properties and relocation of the operations and families involved to other suitable properties, as required by the Uniform Relocation Assistance and Real Properties Acquisition Policies Act of 1970. These actions would erode the local property tax base and cause social problems which would adversely affect the individuals concerned and the local economy.

Condemnation of at least some of the properties would be necessary. This would also adversely affect the people and, in turn, the economy.

Another effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 20,000 recreation visits annually would not be provided. However, purchase of these lands could make an area available for parks and other similar uses to the extent compatible with the existing frequency of flooding. This alternative would essentially meet the sponsors' objectives for land treatment; however, an additional 1,590 acres of upland converted from pastureland and forest land to cropland would require more intensive land treatment to provide adequate conservation measures for the control of erosion and sedimentation. Some of the adverse environmental effects of the planned project would be avoided. Likewise, some of the beneficial effects would be precluded.

STRUCTURAL ALTERNATIVE

Land Treatment and Single-Purpose Water Supply Structures - This alternative would include the installation of the accelerated land treatment only alternative and separate development of water supply systems for Warrenton and Fauquier County. This would involve the construction of single-purpose water supply structures at the proposed sites 3, 4, and 6.

Site 3 would be for the town of Warrenton and sites 4 and 6 would be for Fauquier County.

The construction of these three single-purpose sites would require the purchase of approximately 371 acres of land. About 4.3 miles of perennial stream would be inundated and reservoirs of 58, 109, and 139

acres would be created. The estimated cost of these single-purpose structures, including project administration, was estimated by the consultant to be \$2,982,250.

This alternative would provide the same reduction in sheet erosion on the uplands as the planned project. Water supply structures on Cedar Run would trap sediment and reduce downstream sediment damages about the same as the three multi-purpose structures in the planned project. The water supply objectives of the sponsors could be met by this alternative.

The flood prevention objectives of the sponsors would not be met; the impacts and effects of increased turbidity associated with the construction and operation of the water supply reservoirs would not be avoided. Some of the adverse environmental effects of the planned project would be avoided. Likewise, some of the beneficial effects would be precluded.

NO PROJECT

The No Project Alternative is essentially a "do nothing" approach, and would not change the existing environment. The project area would remain as described in the "Environmental Setting" portion of this report, still facing the water and related land resource problems that initiated this project. This alternative would not provide the flood protection, municipal and industrial water storage, the accelerated land treatment measures for agricultural land, or the water-oriented recreational facilities desired by the sponsors.

Fauquier County, under this alternative situation, would have to depend upon its existing water supply sources for public consumption. Without the P.L. 566 impoundments and associated public utilities planned for the county, the service district concept of controlled development could not be realized. Public utilities are necessary for any high density development, and without them, expansion in the area could be expected to follow the current trend of sprawling, large lot developments, dependent upon private wells and septic systems. The county is already facing some of the adverse consequences associated with this random development.

With no project, flood plain management and erosion and sediment control would be similar to the nonstructural alternatives previously described. Floodwaters would continue to damage flood plain land, utilities, and roads and bridges; sediment would continue to accumulate in the Warrenton Reservoir, downstream in Cedar Run, in Lake Jackson, and in Occoquan Creek. As the use of land changes from predominantly agriculture to partly urban, the volume of future floodwater and the accompanying sediment load will increase, with the local sponsors' water resource problems increasing proportionately.

In terms of agriculture within the project area, the going conservation programs would continue to provide technical assistance to farmers in installing land treatment measures. However, the No Project Alternative precludes the accelerated land use and treatment program that would expend \$146,500 of P.L. 566 funds to supplement the existing \$58,530 to be expended through the current programs over the 8-year installation period. Plans include conservation measures on 4,550 acres of cropland, 8,200 acres of pastureland, and 9,776 acres of forest land and associated wildlife habitat that are scheduled to be accomplished in 8 years. This would require about 30 years to complete under the current going programs.

It is estimated that without implementing the project, the net annual benefits from all purposes which would be lost are at least \$182,294. The 1,268 acres of land committed to the project would be available for other uses, 7.7 miles of perennial streams would not be committed, and all the adverse environmental effects of the planned project would be avoided.

SHORT-TERM VS LONG-TERM USE OF RESOURCES

Fauquier County, including the Cedar Run Watershed Project Area has been, prior to 1950, a rural county with an agriculturally based population and economy. It has not been appreciably impacted by the Washington metropolitan area urbanization that has encompassed the neighboring counties to the north. In the 1950's and early 1960's however, the population growth began to show marked acceleration, the interstate highway system became a reality, bringing the metropolitan area within commuting distance, and evidence of uncontrolled urban sprawl began to appear in the county.

Thus, the county became aware of the need for a formal plan for its future land use. The resulting County Comprehensive Plan, prepared by the Fauquier County Planning Commission, was an attempt to initiate controlled county development 1/. It included objectives broadly outlining harmonious development between service district areas of controlled growth and protection of the existing agricultural community and its natural resource areas; balanced industrial-commercial growth; and public utilities to serve these growth demands.

Although admirable in its conception, the plan had not been effectively implemented, and a five year review was commissioned. The 1972 addendum 2/ reaffirmed the original objectives and restated them to acknowledge the changed emphasis apparent in county policies, and to help achieve implementation of the plan. As recommendations for implementation, the addendum presented explicit policies and programs to be pursued by the county, whose acceptance would represent a greater level of commitment than that which previously existed.

Of the seven priorities for immediate action, five can be stated as having direct relationship to the applicability of the P.L. 566 program planned for the Cedar Run Watershed Project as a direct implementation measure. The Comprehensive Plan recognizes the significance of watershed management as it applies to planning techniques, and to providing the public utilities necessary for anticipated development.

The Lublin, McGaughy Report 3/ on a public utilities system for the county, as included in the Comprehensive Plan, states:

- 1/ Fauquier County, Virginia, A Comprehensive Plan 1967 - 2000.
- 2/ Riukin/Carson, Incorporated, Addendum to the Plan, 1972.
- 3/ Lublin, McGaughy and Associates, a consulting engineering firm retained by Fauquier County in 1964 to study a public utilities system.

"During the period 1970-1980, small impoundments on Carter's Run, Cedar Run, Goose Creek, Turkey Run, and Licking Run could, utilizing the USDA PL-566 Small Watershed Program, provide sufficient supplies in multi-purpose structures to last indefinitely or until a decision is reached on the Salem Church Reservoir, . . ."

The Cedar Run Project Area, from a state planning standpoint, comprises a portion of Regional District 9, the Rappahannock - Rapidan Planning District. The recommendations of the Planning District reiterate the County's Comprehensive Plan concept of service districts for controlled residential and commercial development 1/. The Planning District further recommends the protection of the county's latent water resources for potential municipal usage; critical flood plain, natural, and scenic area protection; and recognizes the value of the county's agricultural lands to the local economy and the dangers of urban encroachment upon them.

The Cedar Run Watershed Project Area is within the Water Resources Council Mid-Atlantic Region (02), and the Potomac River Subregion (0207) 2/. The Potomac River Basin Report includes in its study area the Upper Occoquan Creek, which includes the Cedar Run and neighboring Broad Run Watersheds. The report cites flooding of agricultural lands and local water supply needs as the major water resource related problems.

Agriculture is expected to remain the dominant segment of the project area's economy for the immediate future, with urban development increasing with anticipated county growth. Proposed land treatment measures within the project area are planned to meet the needs of sustained or increased farm productivity. After project installation, it is anticipated that the watershed will urbanize at a faster rate than the remainder of the county. Technical assistance programs, including agricultural and urban practices as well as consulting services provided to developers, will be updated periodically to meet the changing local needs and land uses. With sound resource management and conservation recommendations, the landowners will be better equipped to manage their land and water resources.

The structural measures proposed in this project will not solve any environmental problems in the short term. In fact, pollution problems may occur during construction at the several dam sites in the form of increased stream turbidity and sediment load, high noise and dust levels, and smoke from debris disposal. However, measures will be designed and phases of construction controlled, which will

1/ Rappahannock - Rapidan Planning District Water Quality Management Plan - Phase I, Vol. I, Land Use Plan.

2/ Obers Projections, Regional Economic Activity in the U.S.; Vol. 3, April 1974, U.S. Water Resources Council, Washington, D.C.

minimize these adverse effects of project installation. This short-term pollution will cease after the structures are installed.

The project will reduce options for long-term land use only on the land incorporated into the several dams and associated emergency spillways, 110 acres; inundated perennial streams, 7.7 miles; permanent pools, 486 acres; and to a lesser extent, 672 acres subject to periodic inundation in the flood pools. The project is compatible with the long-term land use trends of the adjacent land resources, and will build more stability into the local economy. Ground water and air resources will not be impaired.

This planned project provides a level of flood protection consistent with the needs and objectives of the present and anticipated use of the flood plain. Installation of the project will effectively solve long-term flooding problems downstream, up to and including the 100-year storm, and will provide favorable conditions allowing improved management practices to be initiated on 3,013 acres of agricultural flood plain land. Proper installation of needed land treatment measures over the entire project area will help increase productivity and also preserve the land resources for future use.

As well as reducing the required maintenance of roads, bridges, and utility crossings downstream, the project's flood protection and sediment storage will appreciably reduce the amount of sediment reaching the Warrenton Reservoir, Lake Jackson, and the Occoquan Reservoir. In an urbanizing watershed, this reduction of sediment will be in consonance with the overall water quality management objectives of the Occoquan Watershed, and the county erosion and sediment control ordinance. Two thousand acre-feet of municipal and industrial water supply contained in three of the impoundments will be available to the county and the town of Warrenton. This will enable the county and the town to develop the public utilities systems necessary to the service district concept of planned development the county has initiated. The county also plans a system of parks within the project area, the core areas of which will be the impoundments created by the project. Incidental recreation provided at two impoundment sites around the developed water resources within the project area will satisfy much of the expanding recreational requirements the county residents desire. Each of these long-term resource uses will aid in the orderly development and intelligent use of the project area's natural resources, while giving consideration to conservation and environmental measures to preserve the lands for use by future generations.

The completed project is expected to be effective in conserving land and water resources long after its designed life of one hundred years. The structures will become less efficient as the sediment storage is utilized, and beyond the economic life expectancy of the structures, some of the water supply storage will be lost to sediment. Flood protection will not decrease significantly however,

due to the high ratio of floodwater storage to sediment storage provided. Periodic removal of accumulated sediment from the impoundments could restore the efficiency of the structures, allowing them to continue to function indefinitely.

There are no other approved P.L. 566 watershed projects within the Occoquan Creek drainage area. The cumulative environmental effects within the project area will include the improvement of water quality and the quality of wildlife habitat. These amenities are due to the effect of land treatment, establishment of a parks system, and the reduction in stream turbidity.

Secondary impacts resulting from the project installation will be the establishment of an adequate public water system, including the water treatment and distribution facilities, and incidental sport fishery and associated recreational opportunities which will be created in connection with the impoundments. This will entail considerable outlay of capital expenditures by the county to develop these facilities 1/. A slight increase in the sales of fishing licenses and retail recreation equipment could be expected. Traffic would increase on secondary roads giving access to the structures.

1/ A user fee will be charged for recreation facilities, not to exceed that amount required to defray operation and maintenance expenses and to recover a portion of the county's investment.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

There are seven floodwater retarding structures planned for the project, three of which contain municipal water storage. The acreages to be committed to the construction of dams and emergency spillways, sediment pools, and municipal water supply pools total approximately 596 acres. As a result of flood producing storms, there could be as many as 672 additional acres temporarily inundated within the flood storage pools. This land will also be committed to the project since it is subject to periodic flooding. Restrictions upon it will be the same as on the 100-year flood plain. The total committed acreage is about 1,268 acres, 1.9 percent of the entire project area. The table on the following page gives a distribution of the current land use acreages committed to the project.

A total of 7.7 miles of perennial streams will be inundated by the several structures and their associated permanent pools. During periods of flood storage, additional amounts of stream channel will be temporarily inundated. There will be no swamps or wetlands flooded by this project ^{1/}. After completion, the structures and their associated reservoirs will have created a total of 17 miles of shoreline, and will possess some intrinsic scenic value. The value of the planned public utilities system to be developed as a result of the municipal water supply impoundments, enabling the urbanizing county to implement its service district concept of controlled development, is immeasurable. The county-owned reservoirs are scheduled to become the nucleus of a public parks system, with public access offering varied incidental recreation opportunities to the citizenry. With proper management, areas not developed for public use, will provide additional habitat for terrestrial and aquatic wildlife.

All land areas developed with federal cost-sharing assistance, in accordance with Public Law 566, must remain in the planned use throughout the evaluated life of the project. They may, however, be assigned to another public agency, which may incorporate the project into its framework of operation, but must continue to operate and maintain the project for its intended function.

The financial and labor resources invested in the installation of this project, will be irretrievable over the short-term. However, with a favorable benefit-cost ratio, this investment will be recovered through reduced costs and realized opportunities during the project's economic life. The total expended for project installation costs, approximately \$4,899,260 including labor and materials

^{1/} Shaw, S.P., and Fredine, G.C., 1956. Wetlands of the United States. U.S. Department of the Interior, Fish and Wildlife Circular 39.

ACRES COMMITTED TO THE PROJECT

Site No.	Project Use	Cropland	Pasture	Forest land & Other	Subtotal	Percent of Total
1	Dam & Spillway		16		16	
	Sediment Pool		45	20	65	
	Flood Pool		70	17	87	
	Turkey Run Subtotals	0	131	37	168	13.2
2	Dam & Spillway		9		9	
	Sediment Pool		24		24	
	Flood Pool		40		40	
	Gupton Run Subtotals	0	73	0	73	5.8
3	Dam & Spillway		10	3	13	
	Sediment Pool		34		34	
	Municipal Storage		24		24	
	Flood Pool		34		34	
	Airlie Subtotals	0	102	3	105	8.3
4	Dam & Spillway		24		24	
	Sediment Pool		53	28	81	
	Municipal Storage		28		28	
	Flood Pool		60	58	118	
	Licking Run Subtotals	0	165	86	251	19.8
5	Dam & Spillway		10		10	
	Sediment Pool		35	17	52	
	Flood Pool	45	69		114	
	Owl Run Subtotals	45	114	17	176	13.9
6	Dam & Spillway		20	8	28	
	Sediment Pool		59	39	98	
	Municipal Storage		41		41	
	Flood Pool		115	76	191	
	Auburn Subtotals	0	235	123	358	28.2
7	Dam & Spillway		10		10	
	Sediment Pool		39		39	
	Flood Pool		70	18	88	
	Mill Run Subtotals	0	119	18	137	10.8
	Total	45	939	284	1,268	100.0
	Percent of Total	3.6	74.0	22.4	100.0	

required for construction, will not be immediately available for other local or national uses. Only the concrete, reinforcing steel, pipe, and the fuel and manpower resources expended during the construction of the proposed structures will be totally irreversible or irretrievable over the long-term.

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

GENERAL

Activities leading to the development of the Cedar Run watershed project plan began with the application for assistance, sponsored jointly by the John Marshall Soil and Water Conservation District; Town of Warrenton; and Fauquier County Board of Supervisors in 1967. The application was approved, without priority, by the Virginia Soil and Water Conservation Commission in December 1967. A priority was established by the State Commission in October 1968, after serious consideration of project objectives and alternatives by the sponsors. Planning authority for development of a watershed project plan was issued by the Administrator of the Soil Conservation Service in October 1970. At that time the following agencies were notified of planning intentions and were requested to furnish any comments or suggestions they might have concerning the project:

- United States Army Corps of Engineers
- United States Department of Agriculture
 - Agricultural Stabilization and Conservation Service
 - Farmers Home Administration
 - Forest Service
- United States Department of Health, Education, and Welfare
- United States Department of the Interior
 - Fish and Wildlife Service
 - Bureau of Mines
 - Bureau of Outdoor Recreation
 - Geological Survey
 - National Park Service
- United States Environmental Protection Agency
- Cooperative Extension Service
- Rappahannock-Rapidan Planning District Commission 1/
- Virginia Department of Highways and Transportation
- Virginia State Archeologist
- Virginia Historic Landmarks Commission
- Virginia Department of Conservation and Economic Development
- Virginia State Water Control Board
- Virginia Commission of Game and Inland Fisheries
- Virginia State Department of Health
- Virginia Soil and Water Conservation Commission
- Virginia Division of Forestry
- Virginia Commission of Outdoor Recreation
- Virginia Department of Agriculture and Commerce
- Virginia Division of Planning and Community Affairs 2/

1/ Areawide clearinghouse.

2/ State clearinghouse.

Information from the U.S. Fish and Wildlife Service was used in describing the fish and wildlife values and their potential. The U.S. Army Corps of Engineers replied that their district has no constructed, authorized, or proposed improvements in the watershed other than a navigation project at the mouth of Occoquan Creek. The Virginia Commission of Outdoor Recreation replied that: "The Game Commission points out, in regard to the straightening and cleaning of stream channels, that they are opposed to this practice in principle and especially in that portion of Turkey Run downstream from proposed impoundments 1 and 2." They further stated that they hope that any watershed improvements would not include channel straightening and cleaning, and that otherwise they knew of "no conflict that this watershed project would have with other existing recreation plans or facilities." The National Register of Historic Places showed no listing for the watershed area. The Virginia Landmarks Commission identified three historic sites, none of which will be affected by project construction. The State Archeologist, based upon his studies, indicated that no known archeological sites would be affected by project construction. The Commission and the State Archeologist indicated that, based upon their studies, there was little likelihood of the existence of historical or archeological values that would be affected by project construction. The Virginia State Water Control Board and the United States Environmental Protection Agency provided information relating to water quality. Publications and other data from the Virginia Division of Planning and Community Affairs provided information relating to economic data, ground water resources, mineral resources, population projections, transportation, utilities, and general area information. U.S. Geological Survey topographic maps and surface water data for the area provided basic watershed information. All information received from these agencies was considered during development of this plan.

Between May of 1967 and November of 1974, 20 news articles and 18 pictures have appeared in local newspapers relating to activities in the Cedar Run watershed. Pamphlets and other communications have been distributed through 5 civic organizations and clubs to inform the people of progress of the studies and evaluations. Eight public meetings were held to inform the public as to what the watershed project would offer, and seeking their views on the project. Letters of endorsement have been received from two civic groups and organizations. These letters set forth the environmental, esthetic, economic, and social values which are of concern to the area.

DISCUSSION AND DISPOSITION OF EACH COMMENT ON DRAFT ENVIRONMENTAL STATEMENT

The agencies which responded to a request for comments on the draft environmental impact statement and plan follow:

Department of the Army
Department of the Interior
Department of Transportation
Environmental Protection Agency
Advisory Council on Historic Preservation
Council on the Environment, Office of the Governor, Commonwealth of Virginia compiled the comments from the following State Agencies:

Virginia Division of State Planning and Community Affairs (State Clearinghouse)
Virginia State Water Control Board
Virginia Department of Health
Virginia Commission of Game and Inland Fisheries
Virginia Air Pollution Control Board
Virginia Soil and Water Conservation Commission
Virginia Commission of Outdoor Recreation
Virginia Department of Agriculture and Commerce
Virginia Department of Conservation and Economic Development
Virginia Marine Resources Commission
Rappahannock-Rapidan Planning District Commission (Areawide Clearinghouse)

Virginia Soil and Water Conservation Commission

Agencies and groups which did not respond to a request for comments on the draft environmental impact statement and plan follow:

Council on Environmental Quality
Department of Commerce
Department of Health, Education, and Welfare
Federal Power Commission
Office of Equal Opportunity
Natural Resources Defense Council
Friends of the Earth
Environmental Defense Fund
National Wildlife Federation
National Audubon Society
Environmental Impact Assessment Project

Summary of Comments and Responses

Each issue, problem, or objection is stated and a response given on the following pages. The comments are serially numbered where agencies have supplied multiple comments. The original letters of comment appear in Appendix C.

Department of the Army

Draft Plan

(1a) Comment: The estimated number and value of the recreation visitor days should be discussed to substantiate the \$35,000 annual recreation benefits.

Response: Fauquier County plans to develop non-project facilities at structures 4 and 6 which will allow incidental use of these reservoirs for fishing. Based on use currently being experienced in Virginia at comparable structures which have been developed in a similar manner, it is estimated that these lakes will provide 20,000 annual user visits. With an average value of \$1.75 per visit, these benefits amount to \$35,000 annually. See Page I-20.

(1b) Comment: The cost for the installation of recreation and sanitary facilities at structures four and six has apparently not been included in the total construction cost, although recreation benefits are claimed for these sites. Also, the recreation costs were not considered in the cost allocation analysis.

Response: Installation of sanitary or other facilities to permit incidental use of structures 4 and 6 for fishing are not part of the planned project features. These items will be installed by Fauquier County as non-project features following construction of structures 4 and 6. Funds for these facilities will be obtained from user fees, not to exceed the amount required to defray the costs of their operation and maintenance and to recover the county's initial investment. See I-23.

(1c) Comment: The estimated operation and maintenance charges of \$1000 for structures 1, 2, 5, and 7; \$1,500 for structure 3; and \$2,000 for structures 4 and 6 appear to be low. At a minimum, supporting data for these estimates should be provided.

Response: Operation and maintenance cost estimates for Cedar Run structures were based on annual maintenance information for similar structures in Virginia which have been constructed 10 to 17 years. Several of these structures sustained emergency spillway flow from Hurricane "Camille" in August 1969 or "Agnes" in June 1972, or both. Based on available information, the annual operation and maintenance costs appear reasonable.

- (1d) Comment: The report states each reservoir will have sufficient capacity to store the expected sediment accumulations over a 100-year period and also to accommodate run-off from the 100-year storm without emergency spillway flow. Will sediment accumulation over the project lives reduce the reservoirs floodwater storage capacities to the extent that emergency spillway flow will occur as a result of a storm less severe than the 100-year event?

Response: Sediment accumulation in the 100-year project life will not result in loss of flood storage. Runoff from storms less severe than the 100-year event will not produce emergency spillway flow.

Draft Environmental Impact Statement

- (2a) Comment: Page II-12, Para.2. This paragraph states that "during construction appropriate measures will be taken to minimize soil erosion as well as water, air, and noise pollution. These measures will be determined for the individual site by evaluating the pollution hazard in relation to established standards for the area in question." Nevertheless, the environmental effects of sedimentation on downstream areas and aquatic life should be more thoroughly discussed.

Response: It is the professional opinion of Service biologists that the short term increases in turbidity during construction (see table on page II-12) will have minimal short term adverse environmental effects. See also Department of the Interior comment number 5 and response.

- (2b) Comment: Page II-67, Para. 2. This paragraph states that turbidity is expected to increase during construction. If this is the case, the environmental effects of turbidity on downstream areas and aquatic life should be more thoroughly discussed.

Response: Same as 2a.

- (2c) Comment: The adverse environmental effects should also include the elimination of certain types of fish which would take place if the reservoir is constructed as shown in the table on page II-69.

Response: No species (types) of fish, threatened, endangered, or otherwise will be eliminated as a result of reservoir construction. About 7.7 miles of perennial stream will be replaced by embankments and reservoirs. Those stream fish that can adapt to reservoirs will survive. Those that cannot survive in the reservoir will be eliminated. Considering there are 102.8 stream miles of this type of habitat available in the watershed area, a loss of 7.7 of this particular type of habitat is not of significant environmental consequence.

U.S. Department of the Interior

Watershed Plan

- (1) Comment: In accordance with Section 12 of the Watershed Protection and Flood Prevention Act (P.L. 83-566), we suggest that public access, in fee or easement, be provided at each impoundment. We also suggest that sufficient storage be incorporated into each impoundment to provide low-flow augmentation.

Response: Soil Conservation Service policy requires that potentials for fish and wildlife and recreation use be appraised for all reservoirs in a watershed project. Findings must be presented to sponsors for their consideration. Analysis of potentials includes determinations of land rights needed for public access, sanitary and recreation facilities necessary for use, and pollution control. The sponsors decided to provide for public access for use at multiple-purpose sites 4 and 6 and to preclude access and use at sites 1, 2, 3, 5, and 7. See pages II-13, II-14 for amplification.

The May 5, 1971 letter from Edward B. Bradley, Field Supervisor, Bureau of Sport Fisheries and Wildlife (now Fish and Wildlife Service) to Tom F. McGourin, State Conservationist, stated a concern for low flow augmentation and a need for public access to all sites.

Water storage to augment flows for fish and wildlife enhancement was not evaluated because of insufficient interest on the part of concerned parties and agencies during planning. Needs must be shown, cost estimates and other arrangements made, and most importantly, a sponsor must agree to share in the cost of storage.

- (2) Comment: The work plan points out that allowances have been made to provide the ten-year, seven-day low flow in only two water supply reservoirs (Nos. 4 and 6). This section should define the amounts of flow for each of the other four impoundments. It should also state whether the flow release, ten-year, seven-day low flow, is a guaranteed minimum flow release.

Response: Sufficient storage has been provided in the three multiple-purpose water supply sites (3, 4, and 6) for minimum downstream releases equal to the 10-year, 7-day low flow. The purpose of this downstream release is to offset the effects of diverting water for municipal and industrial purposes.

The 10-year, 7-day low flows for sites 1, 2, 5, and 7 are 0.18 cfs, 0.05 cfs, 0.06 cfs, and 0.13 cfs respectively. These amounts were not listed in the plan because they are not guaranteed flows. However, Virginia state law requires that the flow below an impoundment be at least equal to the flow immediately above the structure when that flow is equal to or less than the average flow. The design of these structures includes necessary provisions for releasing water to maintain the required downstream flows.

Environmental Statement

- (3) Comment: Project Description

Recreation is not a project purpose; however, a goal was set for the provision of recreation at two of the structure sites. This would include public access roads, parking, boat ramps, and sanitary facilities, and recreational developments compatible with public water supply. The statement should be expanded to indicate the types, location, and magnitude of these recreational developments and their associated environmental impacts.

Response: Where public access is permitted to reservoir sites the Service requires the sponsors to provide for sanitation and other facilities for public safety and protection. Pertinent Federal and State laws and regulations must be adhered to for these developments. Plans for facilities for incidental recreation are preliminary and somewhat general in nature at this point. Since there is no P.L. 566 cost sharing for incidental recreation preliminary plans will meet Service requirements. It follows then, that discussion of these recreational developments and their impacts are of a general nature. However, sufficient information is provided on pages II-13,

II-14 and II-67 to determine the type, location, and general magnitude of the developments and their associated environmental impacts.

- (4) Comment: The impact to fish and wildlife resources of minimum flow releases from all impoundments should be discussed in this section. The Department's Fish and Wildlife Service has pointed out our concern that the "interception of flows by the project dams will result in diminished flows, especially during summer low-flow periods." Reduced flow will detrimentally affect fish and wildlife resources present in downstream areas. These concerns should be addressed in the final environmental statement.

Response: While scientific research material is not conclusive, field studies by the Soil Conservation Service indicate that there is usually an increase in downstream low flows after construction of a dam. This increase in discharge results from prolonged outflow of floodwaters, seepage from the reservoir, and interception of sub-surface flows by the cut-off wall.

The 10-year, 7-day low flow of 0.019 cfs/mi.² discussed in the plan is based on an average for ten gages in the Eastern Potomac River Basin. Seven of these gages recorded minimum mean discharges less than the above value, while two of them recorded zero discharges for the 10-year, 7-day low flow. The gage on Cedar Run at Catlett (D.A. = 93.5 sq. mi.) records ten periods between 1954 and 1966 with periods of zero discharge ranging from 8 to 27 days in length.

The plan provides for a guaranteed release rate equal to the 10-year, 7-day low flow on 27 of the approximately 34 miles of channels below dams. This would amount to greatly increased flows on all but two small tributaries affected by dams. The flow below dams on these two streams will be at least equal to the flow immediately above the structures when that flow is equal to or less than average, as provided by Virginia law.

- (5) Comment: Increased turbidity related to project construction will have an adverse effect on fishery resources in downstream sections. The possibility of confining excavation and dam construction activities to times other than the first spawning season should be included in this section.

Response: The second whole paragraph, page II-67, has been modified to add this statement; "insofar as it is reasonably possible construction activities will be scheduled so that turbidity is not increased during the first spawning season."

- (6) Comment: Wildlife species which normally inhabit the 486 acres of habitat to be inundated will be lost eventually, as surrounding areas are already occupied by the number of species which the land can sustain. In effect, the overall carrying capacity of the watershed will be reduced; some mention of this should be made in the final statement.

Response: The fourth whole paragraph on page II-67 has been amended as follows: "An estimated winter breeding population of three deer, one wild turkey, 10 gray squirrels, and an unknown number of cottontail rabbits and other small animals will be displaced from 104 acres of forest wildlife habitat and 382 acres of pasture which will become pool areas. The overall carrying capacity for these animals will be reduced by loss of 1.7 percent of the total pasture and 0.5 percent of the total forest in the watershed. Some species of fish".

- (7) Comment: Page I-11, states that "...no known archeological values..." will be disturbed by the construction of 7 dams. Page II-48 states that the Virginia State Archeologist had no sites in the area recorded in his files. This is an inadequate consideration of cultural resources.

Response: The State Archeologist is a recognized and official authority in this field. He determined, based upon site location maps, topographic maps, his files and experiences, that no previously identified archeological sites existed within the areas to be disturbed by construction and that there was little likelihood of the existence of such sites within the areas to be disturbed. Pages I-11 of the plan and II-15 and II-48 of the environmental impact statement have been revised to better reflect the work of the State Archeologist.

- (8) Comment: In order to comply with the requirements of the National Environmental Policy Act of 1969 the National Historic Preservation Act of 1966, Executive Order 11593 and Public Law 93-291 of May 24, 1974, the Virginia Historic Preservation Officer should be requested to make a determination and furnish a statement as to whether properties on or eligible for inclusion in the National Register of Historic Places will be affected. As part of the determination, a professional archeological survey and review of the proposed project area should be accomplished in consultation with the State Historic Preservation Officer and documented appropriately. This should include consideration of both historic and prehistoric values.

Response: The National Register of Historic Places shows no listings for the watershed. The Virginia Historic Landmarks Commission identified three sites of historic significance in the watershed. None of the three sites would be affected by construction of the project. The Commission, on the basis of a review of their files, topographic and site maps, has determined there is little likelihood of the existence of historic sites that would be affected by the project. The narrative on page I-11 of the plan and pages II-15 and II-48 of the environmental impact statement have been modified to better reflect the work of the Virginia Historic Landmarks Commission that serves as the State Historic Preservation Officer. See also response to comment number 7.

- (9) Comment: Provision should be made in any land disturbance contracts to allow inspection for and salvage of archeological values which may be found.

Response: See Page I-11 and II-15 for arrangements made to allow for inspection and salvage of archeological values that may be found.

- (10) Comment: The Advisory Council on Historic Preservation should also be consulted if the undertaking will have an effect on properties on or eligible for inclusion of the National Register of Historic Places.

Response: The Advisory Council on Historic Preservation was consulted, (see answers to comments Page II-101) but it was determined that the project will not impact properties on or eligible for inclusion in the National Register of Historic Places. Should historical or archeological values be uncovered during design investigation or construction, provisions of Public Law 93-291 and Public Law 89-665 will be met as applicable.

- (11) Comment: All effects which accrue to cultural resources should be discussed in terms of Section 102 of the National Environmental Policy Act, and a description of alternatives and mitigating measures included therein.

Response: We feel that the Environmental Impact Statement as written adequately addresses effects occurring to cultural resources in compliance with section 102 of the National Environmental Policy Act.

- (12) Comment: Current mineral production in Fauquier County consists of stone valued at less than \$500,000 annually. Although in the past some stone operations existed near the project area, the proposed project should result in no significant impact on the mineral resources of the area.

Response: Agreed.

Alternatives

- (13) Comment: All adverse environmental effects, as well as the beneficial effects, should be itemized for each alternative.

Response: Section 102(2)(D) of the National Environmental Policy Act of 1969 requires the sponsors and the Service to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." It is felt that the alternatives as presented state (a) what the alternative consists of, (b) the level of protection or development provided, (c) expected environmental impacts, and (d) costs, in sufficient detail to provide the rationale for acceptance or rejection of the alternatives.

- (14) Comment: The environmental statement makes a strong case for providing public access to two of the impoundments based on population increases expected in the county and close proximity of the Washington Metropolitan area.

a. For these very same reasons, an alternative should be included which provides for public access at all impoundment sites.

Response: a. Investigations and analyses have shown that incidental recreation at sites 1, 2, 3, 5, and 7 is not technically and/or economically feasible (see response to comment number 1). During the

planning process no agency or party rose to inquire or present plans for additional incidental recreation, or to agree to share in the cost of such an undertaking. It was concluded, therefore, that an alternative which included incidental recreation at all sites would be remote and speculative.

Comment: b. An alternative which provides for increased storage capacity in each impoundment to allow for low-flow augmentation would aid in offsetting adverse impacts related to the planned project.

Response: b. Low-flow augmentation was not considered as it appears to be remote and speculative. During the planning process no agency or party came forth with inquiries or plans showing damages that would be prevented or enhancements gained. There was no interest shown in sponsoring and sharing the cost of such an undertaking. See also comments number 1 and 14a.

Department of Transportation

(1) Comment: The Department of Transportation has reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

Response: Your review and concurrence in this project is appreciated.

U.S. Environmental Protection Agency

- (1) Comment: Mention is made in the report that "because of the flood hazard, the use and management of large areas of flood plain lands of Cedar Run are severely limited". The final EIS should address plans for the flood plain and the expected impact upon the entire watershed. Any proposed development should be viewed in conjunction with compliance to the caveats expressed in Presidential Order No. 11296 of 1966. Page II-1 merely states that there will be "more efficient and effective use of about 3,013 acres of flood plain".

Response: The 3,013 acres of flood plain that will be used more efficiently is presently in agricultural use and will remain in this use with the project (see page II-66 and II-67, as revised, for discussion of effects). Urban or other intensive development is not anticipated, and in fact is restricted by the Virginia Building Code. Further, flood prevention provided is not sufficient to permit intensive development. The local planning commission and the County Supervisors have been notified of these facts. The first sentence of section V, page II-1, has been amended to read, "Average annual damages will be reduced by approximately 66 percent, allowing for more efficient use of about 3,013 acres of agricultural flood plain." Page II-73 has been revised to add more information to item e., and item h. has been added to clarify effects on agricultural land in the protected flood plain.

- (2) Comment: It is difficult to understand how living conditions within the area will be improved if everything listed in paragraphs 3, 4 and 5, page II-2, is expected to take place; i.e., increased noise pollution, vehicular traffic, fire hazard, etc.

Response: The sentence beginning on line 5, second whole paragraph, page II-2, has been changed to read "Certain economic and social conditions in the area will be improved by controlling floodwaters." Item d., page II-73 and paragraph 3, page II-2 have been modified to clarify that the activity will be in and near the recreation areas.

- (3) Comment: On page II-11 it is stated there will be a downstream release rate, from the water supply storage reservoir, equal to the 10 year, seven day low flow. On page II-35 this rate is given as 0.019 cfs/mi². The final EIS should identify a definite minimum daily flow, with assurance that release of water will be sufficient to maintain existing levels of life-forms in the stream below the site of the proposed structure. This information is vital to evaluation of the potential environmental impact of the project.

Response: Provision has been made in the design and operation of the structures to release the flow entering the reservoirs when that flow is equal to or less than average flow. This is required by Virginia law. See response to Department of Interior comments 2 and 4 and also the revised write-up for paragraph 4 on page II-14. Technical language used in the draft plan and EIS is for the benefit of engineering review.

- (4) Comment: Page II-66 reveals that during "drought periods there may be exposure of up to 93 acres of mudflats from drawdown of water supply pools". How often are these conditions expected and are there any mitigating plans?

Response: The environmental impact statement states that a total of 93 acres will be exposed at maximum drawdown for the three water supply structures (24 acres at #3, 28 acres at #4, and 41 acres at #6). The amount of storage for this purpose is based on the most severe drought experienced in the past 25 years. The length of time which the reservoirs will remain below full pool elevations for the maximum draft rates is 9 months each for structures 4 and 6, and 22 months for structure 3. A total area of only 43 acres will be exposed at the three sites whenever 50 percent of the water supply storage is utilized, with a corresponding reduction in the refill periods.

The total draft rate from the three reservoirs is 13.8 cfs (0.3 cfs/mi.²) versus 48.4 cfs (1.0 cfs/mi.² for normal flow. A flow duration analysis indicates that flows equal to the draft rate would be exceeded 50 to 75 percent of the time, which means that drawdown of the water supply pools would only occur when flows in the stream are much below normal. The average land slope of the drawdown areas is 8 percent for the three sites; therefore, mudflats are not expected to occur on these areas. The rolling topography, relatively short slopes, and good vegetative cover above the sites will greatly reduce erosion and thereby reduce the amount of sediment delivered to the pool areas.

- (5) Comment: We believe that the impact of the proposed plan can be more thoroughly presented. Projecting the environmental results of a project without analysing the impact, and mitigating measures, of such major factors as 93 acres of mudflats, increased solid waste and other items as listed on page II-73 under "Adverse Environmental Effects" is not realistic. The final statement should describe methods for lessening the effect of these adverse impacts.

Response: The 93 acres of "mudflats" is explained in response to comment number 4.

Adverse Environmental Effects, Page II-73:

Item a - The write-up has been modified to show that the 7.7 miles of perennial streams is only 7.3 percent of the total perennial streams in the watershed. The narrative description of this effect and the summary has also been modified.

Item b - The second whole paragraph on page II-66 and the second whole paragraph on page II-13, shows what the 1,421 acres is composed of and discusses effects. The only major effects are on 104 acres of forest and 382 acres of pasture. This significant effect is discussed in the second whole paragraph on page II-67.

Item c - The second and third whole paragraphs on page II-12 sets forth arrangements made to control erosion, increased turbidity, and disposal of debris and burning. The last sentence of the third whole paragraph has been modified by adding "...and applicable state regulations governing open burning and fugitive dust."

Item d - This item and other related portions of the Draft Environmental Impact Statement have been modified to show that this effect will be primarily in and near the recreation areas (see response to EPA comment 2). Page II-14, 1st paragraph and page II-20, 4th paragraph - a sentence has been added which reads "Fauquier County will exercise its police and regulatory authority as needed to insure the water supply reservoirs do not become contaminated."

Item e - This item has been clarified as shown.

Item f - Since the term "mudflats" is inappropriate, it has been stricken from the Draft Environmental Impact Statement.

Item h - This item has been added to show effects of intensification of agricultural use. Page II-67 and the summary have also been changed to show this effect.

U.S. Environmental Protection Agency comments of December 9, 1975

- (1) Comment: Presently, no eutrophication potential exists, in any great magnitude, in the Cedar Run Basin. However, with the installation of the proposed impoundments, total utilization of the benefited areas through agriculture and/or pasture lands is expected. We believe that, with the influx of these new activities, there may be the potential for increased nutrient loading on the stream. This could be a particular problem in the stream reach "S" found on the projected map in Appendix B. Here, the increased nutrient loadings could produce eutrophic conditions in structure #6. To alleviate this situation, we recommend that land treatment measures to retard erosion be initially concentrated in this area.

Response: A statement has been added in the second whole paragraph, page II-10, line seven which says, "Special emphasis will be given to accelerated land treatment in reach "S" during project installation to prevent eutrophication of the stream channel by nutrient enrichment".

The project will cause about 50 acres of changed land use on the 260-acre flood plain of Reach S. This will increase the potential for nutrient enrichment because additional fertilizer will be required to produce crops on the 50 acres. To alleviate the potential for stream eutrophication land treatment will be initially concentrated in this area.

- (2) Comment: We are concerned about the potential for thermal and DO stratification at site 3. On page II-12 we note that all multiple purpose structures have a separate intake riser with depth selective gates. Only at site 3 does water from these gates reach the stream. Special precautions should be taken to insure that the gates at site 3 are operated properly, thus diminishing the possibility that aquatic life downstream will be subjected to low DO concentrations or sudden changes in water temperature. We recommend that temperature and DO monitoring be enacted at all 3 gate openings at site 3. This may replace or augment the monitoring system planned at this site on Page II-11

Response: Water will be released to the stream below structure #3 from a maximum depth of 11.3 feet, which should greatly reduce the potential for low dissolved oxygen concentrations. Oxygen will be added to the water as it passes through the Warrenton Reservoir and over a broad-crested concrete weir with a vertical drop of about 20 feet to the streambed below. This intervening reservoir has a surface area of 28 acres and will also reduce the potential for sudden water temperature changes. Considering the situation in its entirety at site #3, and the potential for adverse effects, continuous monitoring of all three gates does not appear to be mandated. However, in the event of lake "roll over" or unforeseen contingencies, special attention will be given operation of this reservoir. To ensure that extra attention be given, a sentence has been added to the paragraph beginning on the bottom of page II-10 and ending on the top of page II-11 "Special precautions will be taken at site number 3 to ensure that low dissolved oxygen and thermal shock do not cause adverse effects on downstream aquatic systems".

The Operation and Maintenance section, second paragraph, page II-20, has also been amended by adding this sentence, "Structure number 3 will be operated so that changes in dissolved oxygen and temperature do not adversely affect downstream aquatic systems."

- (3) Comment: The current Water Quality Standards for the State of Virginia are dated November 1974. On page II-62 the reference for applicable Water Quality Standards of Cedar Run is a VSWCD Report dated 1970. Please be advised of this date change so as to avoid confusion in applicable Water Quality Criteria Reports.

Response: Reference of page II-62 has been changed to reflect the November 1974 date.

Advisory Council on Historic Preservation

a. Compliance with Executive Order 11593 of May 13, 1971

- (1) Comment: In the case of land under the control or jurisdiction of the Federal Government, a statement should be made as to whether or not the proposed undertaking will result in the transfer, sale, demolition, or substantial alteration of potential National Register properties. If such is the case, the nature of the effect should be clearly indicated.

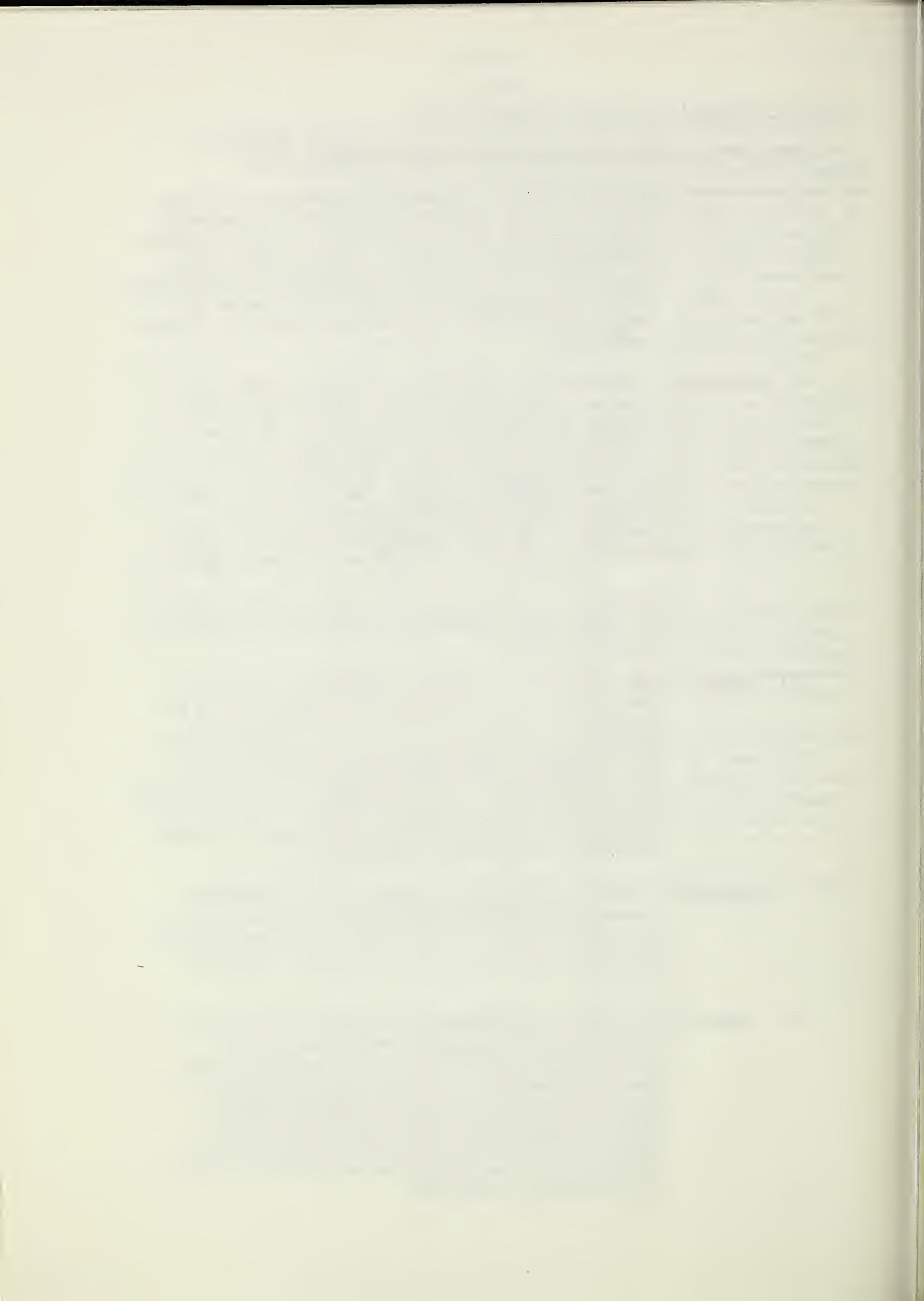
Response: As stated on page II-48, a careful check and review of the National Register of Historical Places was conducted, and no listings were found for the watershed area. The Virginia Historic Landmarks Commission provided the information related to Weston, Neavil's Mill, and Daniel's Mill, as being places of historic interest. To date these places have not been listed in either the state or national registers.

There is no land under control or jurisdiction of the Federal Government that will be affected by this project.

- (2) Comment: In the case of lands not under the control or jurisdiction of the Federal Government such as Weston, Neavil's Mill, and Daniel's Mill, a statement should be made as to whether or not the proposed undertaking will contribute to the preservation and enhancement of non-federally owned districts, sites, buildings, structures, and objects of historical, archeological, architectural, or cultural significance.

Response: This project will contribute to the potential preservation and enhancement of Neavil's Mill and Daniel's Mill by providing flood protection; but will have no effect on Weston. See page II-86.

- (3) Comment: To insure a comprehensive review of historical, cultural, archeological, and architectural resources, the Advisory Council suggests that the environmental statement contain evidence of contact with the appropriate State Historic Preservation Officer and that a copy of his comments concerning the effects of the undertaking upon these resources be included in the environmental statement.



Response: A letter was directed to the Virginia Historic Landmarks Commission dated May 6, 1974 requesting information on any historical places which might be affected by the project. Their reply dated June 3, 1974 lists the three places of historical interest contained in the Environmental Impact Statement. These letters are on file with our basic data.

Commonwealth of Virginia, Office of the Governor, Council on the Environment

- (1) Comment: That adequate protection be given to the reservoirs which will be used as raw water sources for public drinking supplies to prevent possible contamination.

Response: The following sentences were added to the first paragraph of page II-14; "There are no pollution sources which threaten the water supply reservoirs with contamination. Fauquier County will exercise police and regulatory authority as needed to insure the water supply reservoirs do not become contaminated." The following sentence was added to the fourth paragraph, page II-20; "Fauquier County will exercise its police and regulatory authority as needed to insure the water supply reservoirs do not become contaminated."

- (2) Comment: "...construction activity and related land clearing must comply with state regulations governing open burning and fugitive dust".

Response: The sentence beginning on page II-12 and ending on page II-13 has been modified to read "The contractor will also be required to comply with the provisions of the Construction Safety Act of 1969 (PL 91-54), and applicable state regulations governing open burning and fugitive dust."

Virginia Soil and Water Conservation Commission

- (1) Comment: The combined Plan and Environmental Impact Statement for Cedar Run Watershed has been reviewed as requested in your letter dated July 11, 1975. Your staff is commended for its excellent job in combining the Plan and Environmental Impact Statement into one document. I support this concept and hope that it will be continued in the future. We have no comments to offer on either the Plan or the Environmental Impact Statement.

Response: We appreciate your review and comment, and wish to thank you for your continued interest and support.

LIST OF APPENDIXES

APPENDIX A - Comparison of Benefits and Costs for Structural Measures

APPENDIX B - Project Map

APPENDIX C - Letters of Comment Received on the Draft Environmental Statement

APPENDIX D - Typical Land Treatment Practices

APPENDIX E - List of Biota

APPENDIX F - Glossary

APPENDIX G - Water Quality Data for Cedar Run Watershed

APPROVED BY DW Grimwood DATE 3/17/76
D. N. Grimwood
State Conservationist



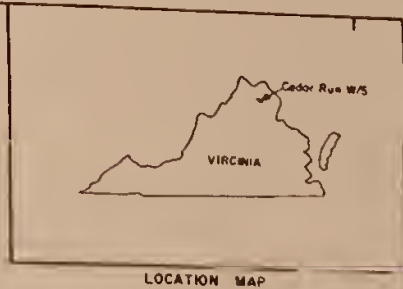
APPENDIX A - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
Cedar Run Watershed, Virginia
(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS <u>1/</u>							Average Annual Cost	Benefit Cost Ratio
	More Intensive Land Use Agr.	Changed Land Use Agr.	Municipal Water Supply	Incidental Recreation	Local Secondary	Total			
All structural Measures	86,345	83,535	27,440	158,200	35,000	42,950	433,470	231,170	1.9:1.0
Project Administration								20,006	
GRAND TOTAL	86,345	83,535	27,440	158,200	35,000	42,950	433,470	251,176	1.7:1.0

1/ Price Base: 1974 - Agricultural values, Current Normalized Prices; all other values current prices (1974).

2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$6,625 annually.

Date: December 1975



- LEGEND
- Road
 - Railroad
 - Pipeline
 - Existing reservoir
 - Stream
 - Town line
 - U.S. Military reservation
 - Watershed boundary
 - Drainage area controlled by structure
 - Area benefited
 - Damage reach
 - Drainage area in acres
- PROJECT MEASURES
- Floodwater retarding structure
 - Multiple purpose structure
 - Structure number



Appendix B

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PROJECT MAP

CEDAR RUN WATERSHED

FAUQUIER COUNTY, VIRGINIA



Base map constructed by
Virginia state office personnel



-C1-

APPENDIX C

Letters of Comment Received on the Draft Environmental Impact Statement





DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY

WASHINGTON, D.C. 20310

28 AUG 1975

Honorable Robert W. Long
Assistant Secretary of Agriculture
Washington, D. C. 20250

Dear Mr. Long:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the Virginia State Conservationist of the Soil Conservation Service, by letter of 11 July 1975, requested the views of the Secretary of the Army on the watershed plan for Cedar Run Watershed, Virginia.

We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department. The draft of the environmental statement satisfies the requirements of Public Law 91-190, 91st Congress, insofar as this Department is concerned.

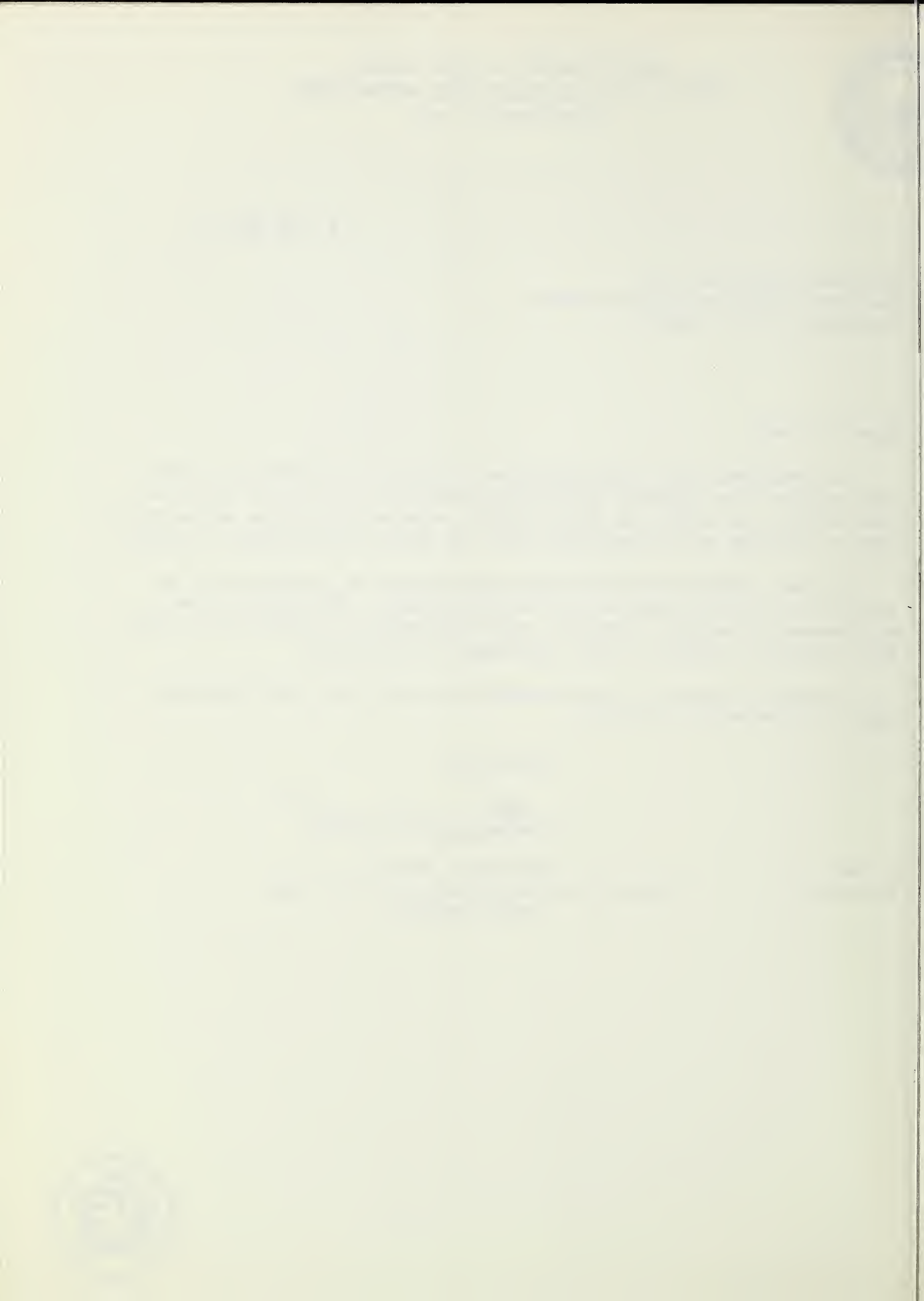
Specific comments on the watershed plan and draft environmental impact statement are inclosed.

Sincerely,

1 Incl
As stated

Charles R. Ford
Deputy Assistant Secretary, of the Army
(Civil Works)





CEDAR RUN WATERSHED, FAUQUIER COUNTY, VIRGINIACOMMENTS1. Draft Plan:

a. The estimated number and value of the recreation visitor days should be discussed to substantiate the \$35,000 annual recreation benefits.

b. The cost for the installation of recreation and sanitary facilities at structures four and six has apparently not been included in the total construction cost, although recreation benefits are claimed for these sites. Also, the recreation costs were not considered in the cost allocation analysis.

c. The estimated operation and maintenance charges of \$1000 for structures 1, 2, 5, and 7; \$1,500 for structure 3; and \$2,000 for structures 4 and 6 appear to be low. At a minimum, supporting data for these estimates should be provided.

d. The report states each reservoir will have sufficient capacity to store the expected sediment accumulations over a 100-year period and also to accommodate run-off from the 100-year storm without emergency spillway flow. Will sediment accumulation over the project lives reduce the reservoirs flood-water storage capacities to the extent that emergency spillway flow will occur as a result of a storm less severe than the 100-year event?

2. Draft Environmental Impact Statement:

a. Page II-12, Para 2. This paragraph states that "during construction appropriate measures will be taken to minimize soil erosion as well as water, air, and noise pollution. These measures will be determined for the individual site by evaluating the pollution hazard in relation to established standards for the area in question." Nevertheless, the environmental effects of sedimentation on downstream areas and aquatic life should be more thoroughly discussed.

b. Page II-67, Para. 2. This paragraph states that turbidity is expected to increase during construction. If this is the case, the environmental effects of turbidity on downstream areas and aquatic life should be more thoroughly discussed.

c. Page II-73. The adverse environmental effects should also include the elimination of certain types of fish which would take place if the reservoir is constructed as shown in the table on page II-69.





United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

SEP 18 1975

PEP ER-75/692

Dear Mr. Grimwood:

Thank you for the letter of July 11, 1975, requesting our views and comments on the work plan and draft environmental statement for Cedar Run Watershed, Fauquier County, Virginia. We have both general and specific comments arranged by page or section designation.

Work Plan

In accordance with Section 12 of the Watershed Protection and Flood Prevention Act (P.L. 83-566), we suggest that public access, in fee or easement, be provided at each impoundment. We also suggest that sufficient storage be incorporated into each impoundment to provide low-flow augmentation.

The work plan points out that allowances have been made to provide the ten-year, seven-day low flow in only two water supply reservoirs (Nos. 4 and 6). This section should define the amounts of flow for each of the other four impoundments. It should also state whether the flow release, ten-year, seven-day low flow, is a guaranteed minimum flow release.

Environmental Statement

Project Description

Recreation is not a project purpose; however, a goal was set for the provision of recreation at two of the structure sites. This would include public access roads, parking, boat ramps, and sanitary facilities, and recreational developments compatible with public water supply. The statement should be expanded to indicate the types, location, and magnitude of these recreational developments and their associated environmental impacts.





Environmental Impact

The impact to fish and wildlife resources of minimum flow releases from all impoundments should be discussed in this section. The Department's Fish and Wildlife Service has pointed out our concern that the "interception of flows by the project dams will result in diminished flows, especially during summer low-flow periods." Reduced flow will detrimentally affect fish and wildlife resources present in downstream areas. These concerns should be addressed in the final environmental statement.

Increased turbidity related to project construction will have an adverse effect on fishery resources in downstream sections. The possibility of confining excavation and dam construction activities to times other than the first spawning season should be included in this section.

Wildlife species which normally inhabit the 486 acres of habitat to be inundated will be lost eventually, as surrounding areas are already occupied by the number of species which the land can sustain. In effect, the overall carrying capacity of the watershed will be reduced; some mention of this should be made in the final statement,

Page 1-11, states that "... no known archeological values ..." will be disturbed by the construction of 7 dams. Page 11-48 states that the Virginia State Archeologist had no sites in the area recorded in his files. This is an inadequate consideration of cultural resources.

In order to comply with the requirements of the National Environmental Policy Act of 1969 the National Historic Preservation Act of 1966, Executive Order 11593 and Public Law 93-291 of May 24, 1974, the Virginia Historic Preservation Officer should be requested to make a determination and furnish a statement as to whether properties on or eligible for inclusion in the National Register of Historic Places will be affected. As part of the determination, a professional archeological survey and review of the proposed project area should be accomplished in consultation with the State Historic Preservation Officer and documented appropriately. This should include consideration of both historic and prehistoric values.



Provision should be made in any land disturbance contracts to allow inspection for and salvage of archeological values which may be found.

The Advisory Council on Historic Preservation should also be consulted if the undertaking will have an effect on properties on or eligible for inclusion of the National Register of Historic Places.

All effects which accrue to cultural resources should be discussed in terms of Section 102 of the National Environmental Policy Act, and a description of alternatives and mitigating measures included therein.

Current mineral production in Fauquier County consists of stone valued at less than \$500,000 annually. Although in the past some stone operations existed near the project area, the proposed project should result in no significant impact on the mineral resources of the area.

Alternatives

All adverse environmental effects, as well as the beneficial effects, should be itemized for each alternative.

The environmental statement makes a strong case for providing public access to two of the impoundments, based on population increases expected in the county and the close proximity of the Washington Metropolitan area. For these very same reasons, an alternative should be included which provides for public access at all impoundment sites. An alternative which provides for increased storage capacity in each impoundment to allow for low-flow augmentation would aid in offsetting adverse impacts related to the planned project.

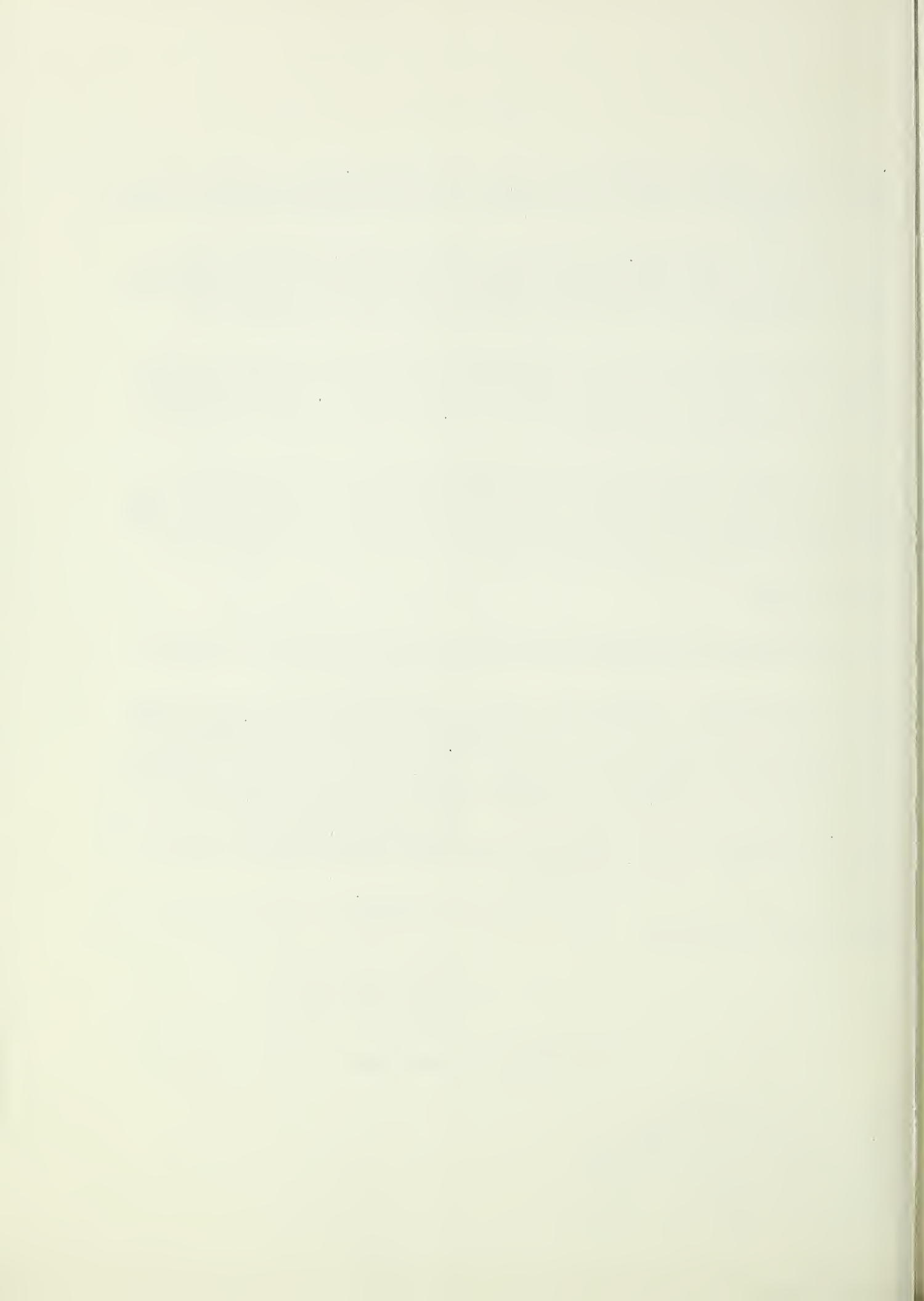
We hope these comments will be of assistance to you in preparing your final documents.

Sincerely yours,



Deputy Assistant Secretary of the Interior

Mr. D. N. Grimwood
State Conservationist
Soil Conservation Service
Department of Agriculture
P. O. Box 10026
Richmond, Virginia 23240





DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
WASHINGTON, D.C. 20590
PHONE: (202) 426-2262

9 SEP 1975

Mr. D. N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240


Dear Mr. Grimwood:

This is in response to your letter of 11 July 1975 addressed to the Commandant, U. S. Coast Guard concerning a draft environmental impact statement for Cedar Run Watershed, Fauquier County, Virginia.

The Department of Transportation has reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

The opportunity to review this draft statement is appreciated.

Sincerely,


D. J. RILEY

Captain, U. S. Coast Guard
Deputy Chief, Office of Marine
Environment and Systems
By direction of the Commandant





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

October 2, 1975

Mr. D.N. Grimwood
State Conservationist
Soil Conservation Service
P.O. Box 10026
Richmond, Virginia 23240

Dear Mr. Grimwood:

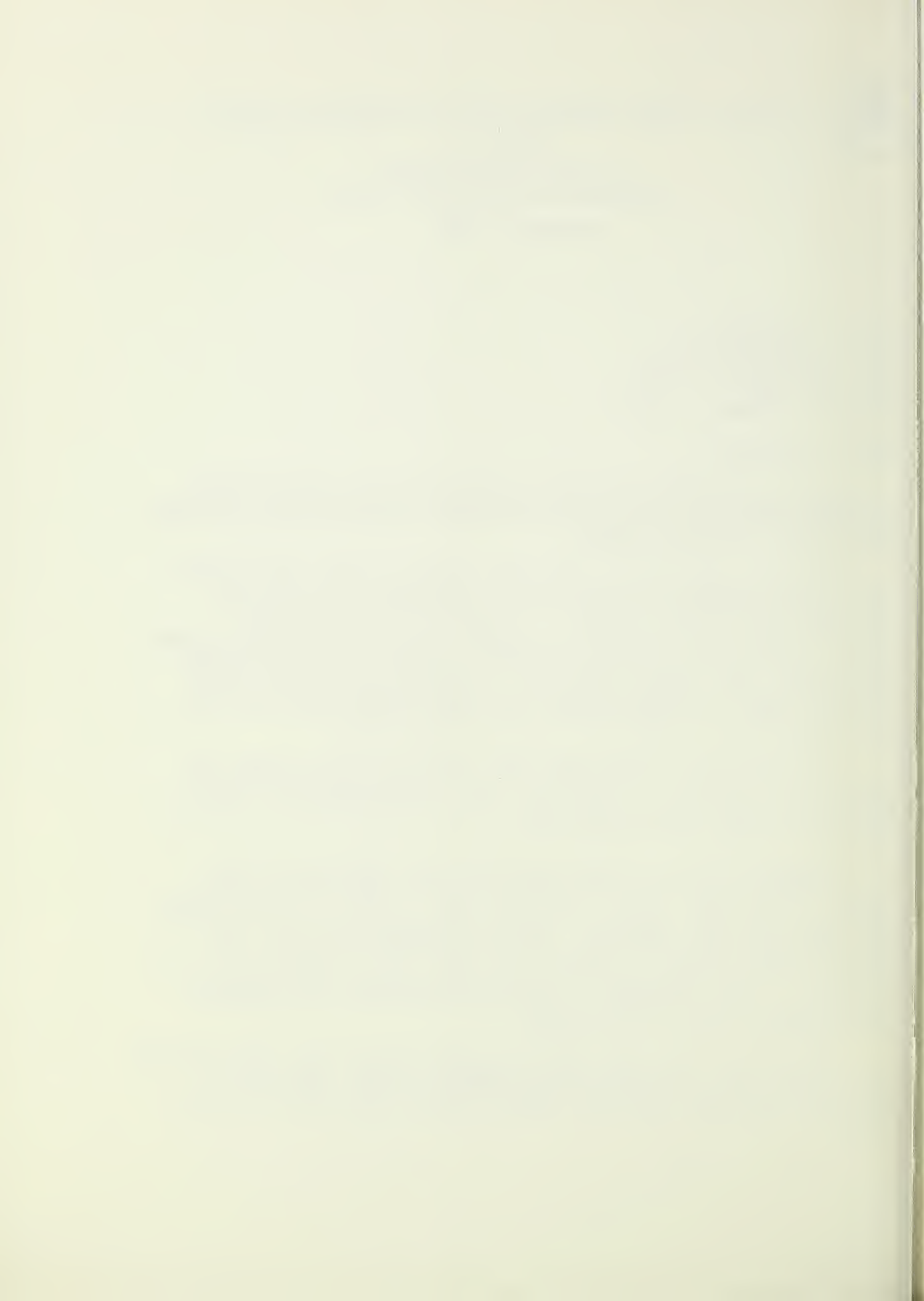
We have completed our review of the Draft Environmental Impact Statement concerning the Cedar Run Watershed, Fanquier County, Virginia. We offer the following comments.

Mention is made in the report that "because of the flood hazard, the use and management of large areas of the flood plain lands of Cedar Run are severely limited". The final EIS should address plans for the flood plain and the expected impact upon the entire watershed. Any proposed development should be viewed in conjunction with compliance to the caveats expressed in Presidential Order No. 11296 of 1966. Page II-1 merely states that there will be "more efficient and effective use of about 3,013 acres of flood plain".

It is difficult to understand how living conditions within the area will be improved if everything listed in paragraphs 3, 4 and 5, page II-2, is expected to take place; i.e., increased noise pollution, vehicular traffic, fire hazard etc.

On page II-11 it is stated there will be a downstream release rate, from the water supply storage reservoir, equal to the 10 year, seven day low flow. On page II-35 this rate is given as 0.019 cfs/mi². The final EIS should identify a definite minimum daily flow, with assurance that release of water will be sufficient to maintain existing levels of life-forms in the stream below the site of the proposed structure. This information is vital to evaluation of the potential environmental impact of the project.

Page II-66 reveals that during "drought periods there maybe exposure of up to 93 acres of mudflats from drawdown of water supply pools". How often are these conditions expected and are there any mitigating plans?

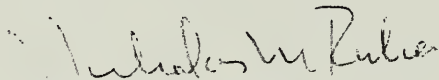


We believe that the impact of the proposed plan can be more thoroughly presented. Projecting the environmental results of a project without analysing the impact, and mitigating measures, of such major factors as 93 acres of mudflats, increased solid waste and other items as listed on page II-73 under "Adverse Environmental Effects" is not realistic. The final statement should describe methods for lessening the effect of these adverse impacts.

On the basis of our review we have placed the project in EPA Reporting Category ER-2. I have enclosed a sheet explaining this rating system. The classification and date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed actions under Section 309 of the Clean Air Act.

We will be glad to furnish whatever assistance we can in resolving the inadequacies found in the Draft Environmental Impact Statement, prior to writing the Final Environmental Impact Statement.

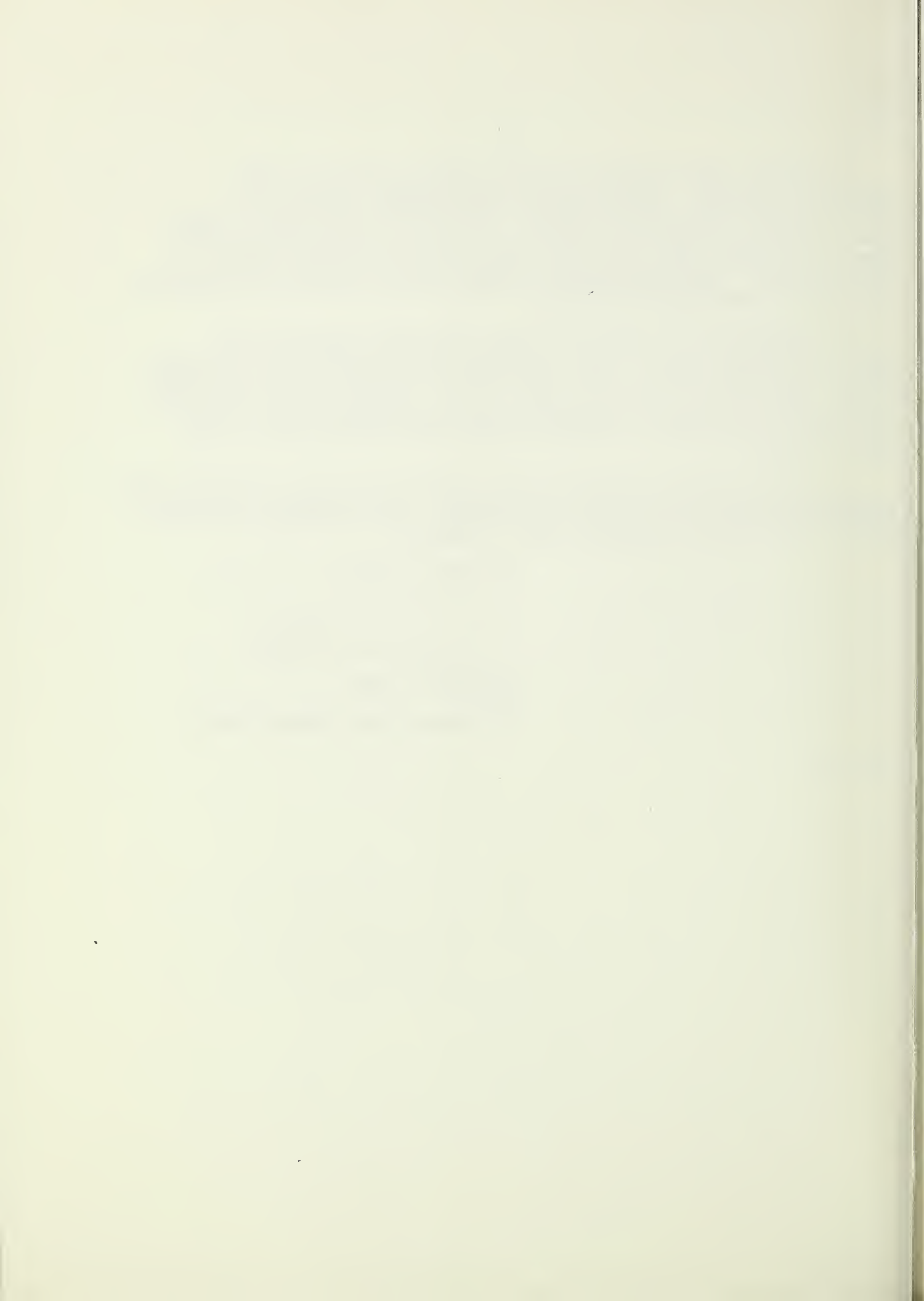
Sincerely yours,



Nicholas M. Ruha
Chief

EIS and Wetlands Review Section

Enclosure





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION III

6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

December 9, 1975

Mr. D. N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240

Dear Mr. Grimwood:

This is in reply to your letter dated November 12, 1975. We anticipate the final statement for the Cedar Run Watershed, however, we still have some reservations. The reservations follow:

Presently, no eutrophication potential exists, in any great magnitude, in the Cedar Run Basin. However, with the installation of the proposed impoundments, total utilization of the benefited areas through agriculture and/or pasture lands is expected. We believe that, with the influx of these new activities, there may be the potential for increased nutrient loading on the stream. This could be a particular problem in the stream reach "S" found on the projected map in Appendix B. Here, the increased nutrient loadings could produce eutrophic conditions in structure #6. To alleviate this situation, we recommend that land treatment measures to retard erosion be initially concentrated in this area.

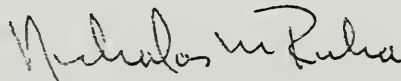
We are concerned about the potential for thermal and DO stratification at site 3. On page II-12 we note that all multiple purpose structures have a separate intake riser with depth selective gates. Only at site 3 does water from these gates reach the stream. Special precautions should be taken to insure that the gates at site 3 are operated properly, thus diminishing the possibility that aquatic life downstream will be subjected to low DO concentrations or sudden changes in water temperature. We recommend that temperature and DO monitoring be enacted at all 3 gate openings at site 3. This may replace or augment the monitoring system planned at this site on Page II-11.

The current Water Quality Standards for the State of Virginia are dated November 1974. On page II-62 the reference for applicable Water Quality Standards of Cedar Run is a VSWCB Report dated 1970. Please be advised of this date change so as to avoid confusion in applicable Water Quality Criteria Reports.

The following statements should be expressed in the Cedar Run Watershed Final EIS so that proper impact assessment can be attained.

Thank you for your cooperation in this matter.

Sincerely,

A handwritten signature in dark ink, appearing to read "Nicholas M. Ruha". The signature is fluid and cursive, with the first name "Nicholas" being more prominent and the last name "Ruha" following in a similar style.

Nicholas M. Ruha
Chief

EIS and Wetlands Review Section



Advisory Council
On Historic Preservation

1522 K Street N.W.
Washington, D.C. 20005

September 5, 1975

Mr. D. N. Grimwood
State Conservationist
United States Department of Agriculture
Soil Conservation Service
P.O. Box 10026
Richmond, Virginia 23240

Dear Mr. Grimwood:

This is in response to your request of July 11, 1975 for comments on the environmental statement for the Cedar Run Watershed, Virginia. Pursuant to its responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969, the Advisory Council on Historic Preservation has determined that while you have discussed the historical, architectural, and archeological aspects related to the undertaking, the Advisory Council needs additional information to adequately evaluate the effects on these cultural resources. Please furnish additional data indicating:

a. Compliance with Executive Order 11593 of May 13, 1971


1. In the case of land under the control or jurisdiction of the Federal Government, a statement should be made as to whether or not the proposed undertaking will result in the transfer, sale, demolition, or substantial alteration of potential National Register properties. If such is the case, the nature of the effect should be clearly indicated.
2. In the case of lands not under the control or jurisdiction of the Federal Government such as Weston, Neavil's Mill, and Daniel's Mill, a statement should be made as to whether or not the proposed undertaking will contribute to the preservation and enhancement of non-federally owned districts, sites, buildings, structures, and objects of historical, archeological, architectural, or cultural significance.



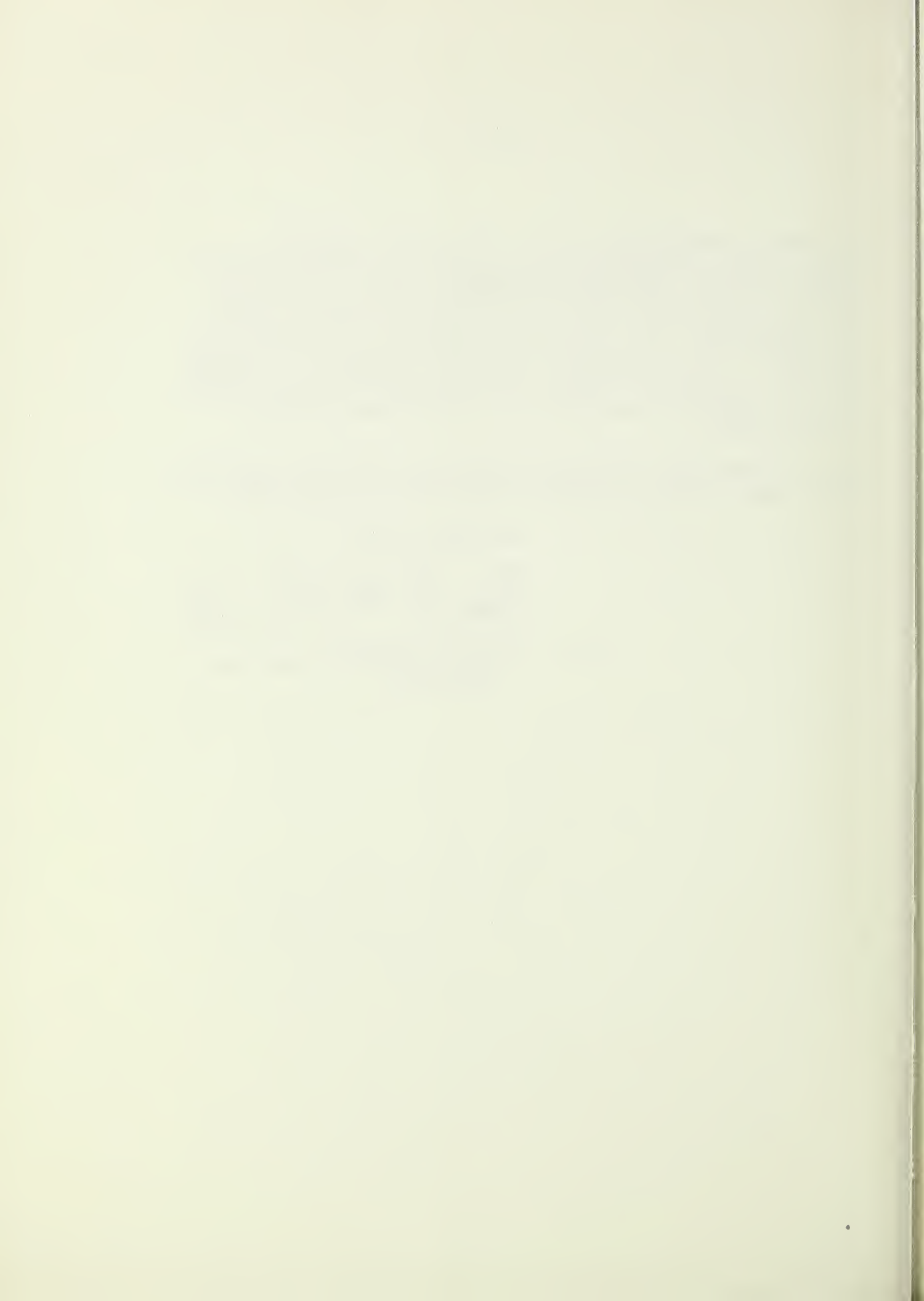
To insure a comprehensive review of historical, cultural, archeological, and architectural resources, the Advisory Council suggests that the environmental statement contain evidence of contact with the appropriate State Historic Preservation Officer and that a copy of his comments concerning the effects of the undertaking upon these resources be included in the environmental statement. The State Historic Preservation Officer for Richmond, Virginia is Junius R. Fishburne, Jr., Executive Director, Virginia Historic Landmarks Commission, 221 Governor Street, Richmond, Virginia 23219.

Should you have any questions or require any additional assistance, please contact Ellen R. Ramsey of the Advisory Council staff.

Sincerely yours,

A handwritten signature in dark ink, reading "John D. McDermott". The signature is fluid and cursive, with a large initial "J" and a long, sweeping underline.

John D. McDermott
Director, Office of Review and
Compliance





COMMONWEALTH of VIRGINIA

Council on the Environment

GERALD P. McCARTHY
ADMINISTRATOR

903 NINTH STREET OFFICE BUILDING
RICHMOND 23219

October 17, 1975

Mr. Ernest R. Blackman
Soil Conservation Service
U.S. Department of Agriculture
P.O. Box 10026
Richmond, Virginia 23240

Subject: Draft Plan and Draft Environmental Impact Statement for
Cedar Run Watershed, Fauquier County, Virginia

Dear Mr. Blackman:

We have completed our review of the subject document.
The following agencies participated in this review:

Division of State Planning and Community Affairs
State Water Control Board
State Department of Health
Commission of Game and Inland Fisheries
Marine Resources Commission
State Air Pollution Control Board
Soil and Water Conservation Commission
Commission of Outdoor Recreation
Department of Conservation and Economic Development
Department of Agriculture and Commerce
Rappahannock-Rapidan Planning District Commission

Based on the comments we received and our own evaluation of the proposal, we have the following observations and conclusions:

Many of the agencies responding have been familiar with this project for quite some time. They and we wish to commend you for your working relationship with the various state agencies. Moreover, it seems that the proposed project is compatible with the objectives, programs and plans of the agencies responding.



Mr. Ernest R. Blackman
October 17, 1975
Page Two

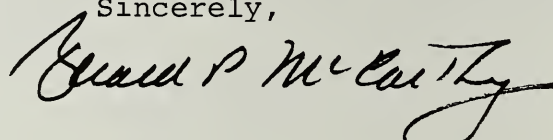
Specifically, the State Division of Forestry has notified us that the forestry data included was obtained from a series of systematically selected plots within the watershed area. They have indicated that the program developed by the Soil Conservation Service is not only a sound forestry program, but also will add to the overall development and enhance the total environment of the Cedar Run area.

The state Water Control Board is satisfied that the project will not have any long-term detrimental effect on state waters. The Health Department likewise endorses the project with the following suggestion: That adequate protection be given to the reservoirs which will be used as raw water sources for public drinking supplies to prevent possible contamination.

As a final note, the State Air Pollution Control Board has indicated that while the project should have no permanent effect on ambient air quality, construction activity and related land clearing must comply with state regulations governing open burning and fugitive dust.

Thank you for the opportunity to comment.

Sincerely,

A handwritten signature in cursive script, reading "Gerald P. McCarty". The signature is written in dark ink and is positioned below the word "Sincerely,".

GPM:dls

cc: Honorable Earl J. Shiflet, Secretary of Commerce and Resources
Mr. W. F. Custard, State Forester, Department of Conservation
and Economic Development
Mr. J. L. Hamrick, State Water Control Board
Mr. Oscar H. Adams, State Health Department
Mr. Paul Pitts, State Air Pollution Control Board



R. DuVal Dickinson, *Chairman*
Fredericksburg
Henry C. Green, *Vice Chairman*
Markham
S. Mason Carbaugh, *Richmond*
P. W. Davis, *Davis Wharf*
Donald D. Gray, *Castlewood*
David N. Grimwood, *Richmond*
W. Rogers Meador, *Goochland*
W. E. Skelton, *Blacksburg*
M. M. Sutherland, *Richmond*
Elmer M. Venskoske, *Winchester*
R. E. Wilkinson, *Kenbridge*
Coyt T. Wilson, *Blacksburg*



COMMONWEALTH of VIRGINIA

VIRGINIA SOIL AND WATER CONSERVATION COMMISSION

830 EAST MAIN STREET

Joseph B. Willson, Jr.
Director

POST OFFICE BOX 1163
RICHMOND, VIRGINIA 23209
(804) 770-2064

August 27, 1975

Mr. David N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240

Dear Dave:

The combined Plan and Environmental Impact Statement for Cedar Run Watershed has been reviewed as requested in your letter dated July 11, 1975. Your staff is commended for its excellent job in combining the Plan and Environmental Impact Statement into one document. I support this concept and hope that it will be continued in the future. We have no comments to offer on either the Plan or the Environmental Impact Statement.

Sincerely,

Joseph B. Willson, Jr.
Director

JBWjr:kc



APPENDIX D

Typical Land Treatment Practices used in providing conservation treatment of land.

1. Access Road
2. Agricultural Waste Management System
3. Conservation Cropping System
4. Contour Farming
5. Critical Area Planting
6. Debris Basin
7. Diversion
8. Field Border
9. Grassed Waterway or Outlet
10. Gravel Outlet Structure
11. Heavy Use Area Protection
12. Hydrologic Cultural Operations
13. Level Spreader
14. Minimum Tillage
15. Pasture and Hayland Management
16. Recreation Area Improvement
17. Skid Trail and Logging Road Erosion Control
18. Storm Drain Outlet Protection
19. Straw Bale Barrier
20. Tree Planting
21. Wildlife Upland Habitat Management
22. Woodland Grazing Control
23. Woodland Improved Harvesting
24. Woodland Improvement

Definitions and Purposes

1. Access Road ^{1/}: road constructed as part of a conservation plan to provide needed access. Provides access to farms, ranches, fields, conservation systems, structures, and recreation areas; provides a route for travel, for moving equipment and supplies; and provides access for proper operation and management of conservation enterprises.
2. Agricultural Waste Management System ^{1/}: a planned agricultural waste management system to contain and manage liquid and solid wastes including runoff from concentrated waste areas, with ultimate disposal in a manner which does not degrade air, soil, or water resources, and protects public health and safety. This practice includes systems for safe disposal of livestock wastes, municipal waste treatment plant effluents and sludges, and agricultural processing wastes through use of soil and plants.
3. Conservation Cropping System ^{2/}: growing crops in combination with needed cultural and management measures. Cropping systems include rotations that contain grasses and legumes as well as rotations in which the desired benefits are achieved without the use of such crops. Designed to improve or maintain good physical

condition of the soil; protect the soil during periods when erosion usually occurs; help control weeds, insects, and diseases; and meet the needs and desires of farmers for economic returns,

4. Contour Farming^{2/}: farming sloping cultivated land in such a way that plowing, preparing land, planting, and cultivating are done on the contour (includes following established grades of terraces, diversions, or contour strips) in order to reduce erosion and control water.
5. Critical Area Planting^{2/}: planting vegetation such as trees, shrubs, vines, grasses, or legumes on critical areas to stabilize the soil; reduce damage from sediment and runoff to downstream areas; improve wildlife habitat; and enhance natural beauty.
6. Debris Basin^{1/}: barrier or dam constructed across a waterway or at other suitable locations to form a silt or sediment basin that will preserve the capacity of reservoirs, ditches, canals, diversions, waterways and streams; prevent undesirable deposition on bottomlands and developed areas; trap sediment originating from construction sites; and reduce or abate pollution by providing basins for deposition and storage of silt, sand, gravel, stone, agricultural wastes, and other detritus.
7. Diversion^{1/}: channel with a supporting ridge on the lower side constructed across the slope for the purpose of diverting water from areas where it is in excess to sites where it can be used or disposed of safely.
8. Field Border^{2/}: border or strip of perennial vegetation established at the edge of a field by planting, or by converting it from trees to herbaceous vegetation or shrubs, in order to control erosion; protect edges of fields that are used as "turn rows" or travel lanes for farm machinery; reduce competition from adjacent woodland; provide wildlife food and cover; or improve the landscape.
9. Grassed Waterway or Outlet^{1/}: natural or constructed waterway or outlet shaped or graded and established in suitable vegetation as needed for the safe disposal of runoff from a field, diversion, terrace, or other structure; they provide for the disposal of excess surface water from terraces, diversions, or from natural conditions without damage by erosion or flooding.
10. Gravel Outlet Structure^{4/}: an auxiliary structure installed in combination with and as a part of a diversion, interceptor or perimeter dike, or other structures designed to temporarily detain sediment-laden storm water. The gravel outlet provides a means of draining off and filtering the storm water while retaining the sediment behind the structure.

11. Heavy Use Area Protection^{2/}: protecting heavily used areas by establishing vegetative cover, by surfacing with suitable materials, or by installing needed structures. This practice is used to stabilize an urban, recreation or essential facility area subjected to sustained heavy use by people, animals or vehicles.
12. Hydrologic Cultural Operations^{3/}: These cultural operations are aimed at improving hydrologic conditions in woodland by manipulation of stand composition to create favorable conditions for the maximum production and protection of litter, humus, and forest cover. They include supplemental plantings, weedings, thinnings, improvement, release and harvest cuttings.
13. Level Spreader^{4/}: a temporary outlet constructed at zero grade across the slope whereby concentrated runoff may be discharged at non-erosive velocities onto undisturbed areas stabilized by existing vegetation. The spreader is designed to convert a concentrated flow of storm runoff into sheet flow and to outlet it without causing erosion.
14. Minimum Tillage^{2/}: limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage. This practice retards deterioration of soil structure; reduces soil compaction and formation of tillage pans; and improves soil aeration, permeability, and tilth.
15. Pasture and Hayland Management^{2/}: proper treatment and use of pastureland or hayland for the purpose of prolonging life of desirable forage species; maintaining or improving the quality and quantity of forage; and protecting the soil and reducing water loss.
16. Recreation Area Improvement^{2/}: establishing grasses, legumes, vines, shrubs, trees, or other plants or selectively reducing stand density and trimming woody plants to improve the attractiveness and usefulness of an area for recreation and to protect the soil and plant resources.
17. Skid Trail and Logging Road Erosion Control^{3/}: to reduce runoff, erosion, and sedimentation by diverting water from skid trails and logging roads. Simple water bars (ditches with pole or earthen diversions) spaced at specified intervals are the usual means used to divert this type of surface runoff.
18. Storm Drain Outlet Protection^{4/}: paved and/or riprapped channel sections, placed below storm drain outlets, to reduce velocity of flow before it enters receiving channels.
19. Straw (or Hay) Bale Barrier^{4/}: a temporary barrier installed across, or at the toe of, a slope to intercept and detain sediment from areas one-half acre or smaller, where only sheet erosion may be a problem.

20. Tree Planting^{2/}: planting tree seedlings or cuttings in order to establish or reinforce a stand of trees to conserve soil and moisture, beautify an area, protect a watershed, or produce wood crops.
21. Wildlife Upland Habitat Management^{2/}: retaining, creating, or managing wildlife habitat (other than wetland) to keep, make, or improve habitat for desired kinds of wildlife.
22. Woodland Grazing Control^{3/}: fencing out domestic livestock to prevent impairment of hydrologic conditions in woodlands by reducing soil compaction, damage to tree roots, seedlings, and other ground cover and the loss of litter and humus.
23. Woodland Improved Harvesting^{2/}: systematically removing some of the merchantable trees from an immature stand or all the trees from a designated part of a woodland to improve the conditions for forest growth and/or to harvest trees in a manner that encourages the regeneration and normal development of a new stand.
24. Woodland Improvement^{2/}: improving woodland by removing unmerchantable or unwanted trees, shrubs, or vines in order to fully use the potential of a site; to maintain plant cover for soil protection; to improve stand composition by leaving the best trees, spaced for best growth; to improve forage production on grazable woodland; or to improve the natural beauty, wildlife, or recreation values of the area.

1/ Engineering Practice Standards and Specifications for Soil and Water Conservation in Virginia, Soil Conservation Service, United States Department of Agriculture, September 1973.

2/ National Handbook of Conservation Practices, United States Department of Agriculture, Soil Conservation Service, July 1971.

3/ Forest Service.

4/ Virginia Erosion and Sediment Control Handbook, Virginia Soil and Water Conservation Commission, April 1974.

APPENDIX E

LIST OF BIOTA

PLANTS COMMON TO CEDAR RUN WATERSHED

CROPS

<u>Common Name</u>	<u>Scientific Name</u>
Corn	<i>Zea mays</i>
Oats	<i>Avena sativa</i>
Rye	<i>Secale cereale</i>
Wheat	<i>Triticum aestivum</i>
Ky-31 fescue	<i>Festuca arundinacea</i>
Orchard grass	<i>Dactylis glomerata</i>
Redtop	<i>Agrostis alba</i>
Italian ryegrass	<i>Lolium multiflorum</i>
Sudan grass	<i>Sorghum sudanensis</i>
Ladino clover	<i>Trifolium repens latum</i>
Korean lespedeza	<i>Lespedeza stipulaceae</i>
Sericea lespedeza	<i>Lespedeza cuneata</i>
Soybeans	<i>Glycine max</i>
White clover	<i>Trifolium repens</i>
Sweet clover	<i>Melilotus spp.</i>
Sorghum	<i>Sorghum spp.</i>
Barley	<i>Hordeum spp.</i>
Alfalfa	<i>Medicago spp.</i>
Timothy	<i>Phleum pratense</i>

WEEDS

Pigweed	<i>Amaranthus spp.</i>
Hemp dogbane	<i>Apocynum cannabinum</i>
Chickweed	<i>Stellaria spp.</i>
Lambsquarter	<i>Chenopodium album</i>
Ragweed	<i>Ambrosia artemisiiflora</i>
Giant ragweed	<i>Ambrosia trifida</i>
Whiteheath Aster	<i>Aster pilosus</i>
Thistle	<i>Cirsium spp.</i>
Annual fleabane	<i>Erigeron annuus</i>
Horseweed	<i>Erigeron canadensis</i>
Cudweed	<i>Gnaphalium spp.</i>
Wild lettuce	<i>Lactuca scariola</i>
Goldenrod	<i>Solidago spp.</i>
Dandelion	<i>Taraxacum officinale</i>
Coralberry	<i>Symphoricarpos orbiculatus</i>
Morning glory	<i>Ipomoea spp.</i>
Wild mustard	<i>Brassica kaber</i>
Pepperweed	<i>Lepidium virginicum</i>
Spurge	<i>Euphorbia spp.</i>
Dock	<i>Rumex spp.</i>
Pokeweed	<i>Phytolacca americana</i>
Corn cockle	<i>Agrostemma githago</i>
Primrose	<i>Oenothera spp.</i>

PLANTS COMMON TO CEDAR RUN WATERSHED (Continued)

WEEDS

<u>Common Name</u>	<u>Scientific Name</u>
Wild onion	<i>Allium</i> spp.
Plantain	<i>Plantago</i> spp.
Wild carrot	<i>Dacus carota</i>
Henbit	<i>Lamium amplexicaule</i>
Shepherd's purse	<i>Capsella bursa-pastoris</i>
Red sorrel	<i>Rumex acetosella</i>
Trumpet vine	<i>Campsis tadicans</i>

LEGUMES

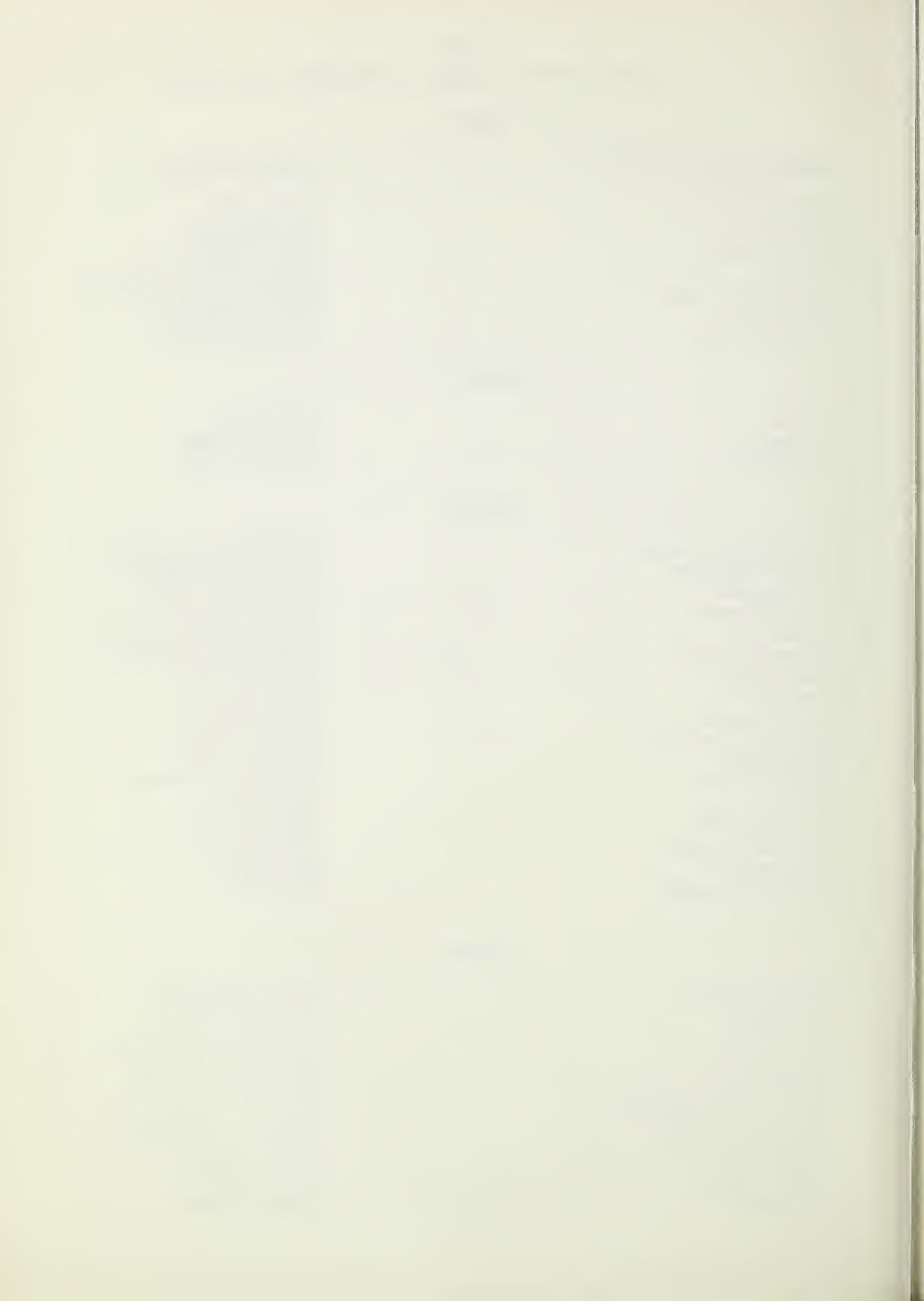
Vetch	<i>Vicia</i> spp.
Clovers	<i>Trifolium</i> spp.
Tickclover	<i>Desmodium</i> spp.

GRASSES

Broomsedge bluestem	<i>Andropogon virginicus</i>
Little bluestem	<i>Andropogon scoparius</i>
Indiangrass	<i>Sorghastrum nutans</i>
Bermudagrass	<i>Cynodon dactylon</i>
Crabgrass	<i>Digitaria sanguinalis</i>
Barnyard grass	<i>Echinochloa crusgalli</i>
Goosegrass	<i>Eleusine indica</i>
Foxtail	<i>Setaria</i> spp.
Johnsongrass	<i>Sorghum halepense</i>
Purpletop tridens	<i>Tridens flavus</i>
Cheatgrass	<i>Bromu tectorum</i>
Orchardgrass	<i>Dactylis glomerata</i>
Fescue	<i>Festuca</i> spp.
Low paspalums	<i>Paspalum</i> spp.
Low panic grass	<i>Panicum</i> spp.
Witchgrass	<i>Leptoloma</i> spp.
Annual bluegrass	<i>Poa annua</i>

SHRUBS

Smooth alder	<i>Alnus serrulata</i>
Arrowwood	<i>Viburnum dentatum</i>
Blueberry	<i>Vaccinium</i> spp.
Haw, black	<i>Veburnum prunifolium</i>
Hawthorn	<i>Crataegus coccinea</i>
Mapleleaved viburnum	<i>Viburnum acerifolium</i>
Sweet pepperbush	<i>Clethra alnifolia</i>
Strawberry bush	<i>Euonymus americanus</i>
Dwarf sumac	<i>Rhus copallina</i>
Smooth sumac	<i>Rhus glabra</i>
Spicebush	<i>Lindera benzoin</i>



PLANTS COMMON TO CEDAR RUN WATERSHED (Continued)

TREES

<u>Common Name</u>	<u>Scientific Name</u>
Ash	<i>Fraxinus</i> , spp.
Red river birch	<i>Betula nigra</i>
Eastern red cedar	<i>Juniperus virginiana</i>
Wild cherry	<i>Prunus serotina</i>
Flowering dogwood	<i>Cornus florida</i>
Box elder	<i>Acer negundo</i>
American elm	<i>Ulmus americana</i>
Slippery elm	<i>Ulmus rubra</i>
Black gum	<i>Nyssa sylvatica</i>
Sweet gum	<i>Liquidambar styraciflua</i>
Hackberry	<i>Cletis occidentalis</i>
Bitternut hickory	<i>Carya cordiformis</i>
Mockernut hickory	<i>Carya tomentosa</i>
Pignut hickory	<i>Carya glabra</i>
American holly	<i>Ilex opaca</i>
Ironwood	<i>Carpinus caroliniana</i>
Black locust	<i>Robinia pseudoacacia</i>
Red maple	<i>Acer rubrum</i>
Silver maple	<i>Acer saccharinum</i>
Black oak	<i>Quercus velutina</i>
Black jack oak	<i>Quercus marilandica</i>
Chestnut oak	<i>Quercus montana</i>
Northern red oak	<i>Quercus rubra</i>
Post oak	<i>Quercus stellata</i>
Scarlet oak	<i>Quercus coccinea</i>
Southern red oak	<i>Quercus falcata</i>
Water oak	<i>Quercus nigra</i>
White oak	<i>Quercus alba</i>
Willow oak	<i>Quercus phellos</i>
Persimmon	<i>Diospyros virginiana</i>
Loblolly pine	<i>Pinus taeda</i>
Shortleaf pine	<i>Pinus echinata</i>
Virginia pine	<i>Pinus virginiana</i>
Yellow poplar	<i>Liriodendron tulipifera</i>
Redbud	<i>Cercis canadensis</i>
Sassafras	<i>Sassafras albidum</i>
Serviceberry	<i>Amelanchier canadensis</i>
Osage-orange	<i>Maclura pomifera</i>
Sycamore	<i>Platanus occidentalis</i>
Black walnut	<i>Juglans nigra</i>
Black willow	<i>Salix nigra</i>



FISH COLLECTED IN
CEDAR RUN PROJECT AREA

Common Name	Scientific Name	Cedar Run (3) Airlie Site	Cedar Run Auburn Site	Gupton Run Rt.602 Bridge	Licking Run Site 4	Mill Run 300 yds. below Rt.605	Turkey Run Rt.602	Total Number Fish - Each Species
Redfin pickerel	<i>Esox americanus</i>	15		1	7	3	6	17
Rosyside dace	<i>Clinostomus funduloides</i>			1				16
Cutlips minnow	<i>Exoglossum maxilllingua</i>	8	4	1		4	13	30
River chub	<i>Nocomis micropogon</i>		51			2	2	55
Golden shiner	<i>Notemigonus crysoleucas</i>			8				8
Comely shiner	<i>Notropis amoenus</i>		20			23		23
Satinfin shiner	<i>N. analostanus</i>		15		14	5	7	46
Common shiner	<i>N. cornutus</i>			5		101		121
Spottail shiner	<i>N. hudsonius</i>				1	1		2
Swallowtail shiner	<i>N. procerus</i>				3	33	13	49
Rosyface shiner	<i>N. rubellus</i>		8					8
Bluntnose minnow	<i>Pimephales notatus</i>	15	24	12	24	125	3	203
Blacknose dace	<i>Rhinichthys atratulus</i>	82						82
Fallfish	<i>Semotilus corporalis</i>	49	2	4		8	6	59
White sucker	<i>Catostomus commersoni</i>	13		5		15	3	38
Creek chubsucker	<i>Erimyzon oblongus</i>					7		15
Northern hog sucker	<i>Hypentelium nigricans</i>		1					1
Yellow bullhead	<i>Ictalurus natalis</i>		1		4	2	1	8
Brown bullhead	<i>I. nebulosus</i>					1		1
Margined madtom	<i>Noturus insignis</i>		1		6		3	10
Redbreast sunfish	<i>Lepomis auritus</i>		40	12	65	26	26	169
Green sunfish	<i>L. cyanellus</i>	13	1	5	1		2	22
Pumpkinseed	<i>L. gibbosus</i>				5	1	2	8
Bluegill	<i>L. macrochirus</i>		2	6	53			63
Hybrid sunfish	<i>L. hybrids</i>			2	1	2		3



FISH COLLECTED IN
CEDAR RUN PROJECT AREA

Common Name	Scientific Name	Cedar Run (3) Airlie Site	Cedar Run Auburn Site	Gupton Run Rt.602 Bridge	Licking Run Site 4	Mill Run 300 yds. below Rt. 605	Turkey Run Rt.602	Total Number Fish - Each Species
Smallmouth bass	<i>Micropterus dolomieu</i>		4					4
Largemouth bass	<i>M. salmoides</i>	47	4	1	9	1		9
Fantail darter	<i>Etheostoma flabellare</i>	1	1		2	6	2	55
Tessellated darter	<i>E. olmstedii</i>		1				7	17
Shield darter	<i>Percina peltata</i>							1
Total number fish per site		243	180	63	195	366	96	1,143
Total weight of fish per site		2 lbs. 3 oz.	3 lbs. 5 oz.	12 oz.	5 lbs. 10 oz.	2 lbs. 1 oz.	5 lbs.	19 lbs.
Average 60.15 fish per pound								



MAMMAL SPECIES COMMONLY OBSERVED IN THE CEDAR RUN WATERSHED AREA

<u>Common Name</u>	<u>Scientific Name</u>
Whitetail deer	<i>Odocoileus virginianus</i>
Opossum	<i>Didelphis virginiana</i>
Raccoon	<i>Procyon lotor</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Woodchuck	<i>Marmota monax</i>
Gray squirrel	<i>Sciurus carolinensis</i>
Eastern chipmunk	<i>Tamias striatus</i>
Beaver	<i>Castor canadensis</i>
Muskrat	<i>Ondatra zibethicus</i>
River otter	<i>Lutra canadensis</i>
Shorttail weasel	<i>Mustela erminea</i>
Mink	<i>Mustela vison</i>
Striped skunk	<i>Mephitis mephitis</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Voles	<i>Microtus</i> spp.
Mice	<i>Peromyscus</i> spp.
Red fox	<i>Vulpes fulva</i>

AMPHIBIANS AND REPTILES OBSERVED IN CEDAR RUN

<u>Common Name</u>	<u>Scientific Name</u>
Red-spotted newt	<i>Diemictylus viridescens</i>
American toad	<i>Bufo americanus</i>
Spring peeper	<i>Hyla crucifer</i>
Bullfrog	<i>Rana catesbeiana</i>
Green frog	<i>R. clamitans</i>
Leopard frog	<i>R. pipiens</i>
Northern water snake	<i>Natrix sipedon</i>
Garter snake	<i>Thamnophis sirtalis</i>
Black racer	<i>Coluber constrictor</i>
King snake	<i>Lampropeltis getulus</i>
Copperhead	<i>Agkistrodon contortrix</i>
Eastern box turtle	<i>Terrapene carolina</i>
Common snapping turtle	<i>Chelydra serpentina</i>



BIRD SPECIES COMMONLY OBSERVED IN THE CEDAR RUN WATERSHED AREA

<u>Common Name</u>	<u>Scientific Name</u>
Wild turkey	<i>Meleagris gallopavo</i>
Bobwhite quail	<i>Colinus virginianus</i>
Mourning dove	<i>Zenaidura macroura</i>
Rock dove	<i>Columba livia</i>
Mallard	<i>Anas platyrhynchos</i>
Black duck	<i>Anas rubripes</i>
American widgeon	<i>Mareca americana</i>
Wood duck	<i>Aix sponsa</i>
Redtailed hawk	<i>Buteo borealis</i>
Marsh hawk	<i>Circus hudsonius</i>
Sparrow hawk	<i>Falco sparverius</i>
Great horned owl	<i>Bubo virginianus</i>
Screech owl	<i>Otus asio</i>
Turkey vulture	<i>Cathartes aura</i>
Black vulture	<i>Coragyps atratus</i>
Crow	<i>Corvus brachyrhynchos</i>
Chimney swift	<i>Chaetura pelagica</i>
Barn swallow	<i>Hirundo rustica</i>
Yellow-shafted flicker	<i>Colaptes auratus</i>
Blue jay	<i>Cyanocitta cristata</i>
Tufted titmouse	<i>Parus bicolor</i>
Mockingbird	<i>Mimus polyglottos</i>
Brown thrasher	<i>Toxostoma rufum</i>
Robin	<i>Turdus migratorius</i>
Starling	<i>Sturnus vulgaris</i>
Eastern meadowlark	<i>Sturnella magna</i>
Red-wing blackbird	<i>Agelaius phoeniceus</i>
Common grackle	<i>Quiscalus quiscula</i>
Cardinal	<i>Richmondia cardinalis</i>
Indigo bunting	<i>Passerina cyanea</i>
Slate-colored junco	<i>Junco hyemalis</i>
English (house) sparrow	<i>Passer domesticus</i>
Grasshopper sparrow	<i>Ammodramus savannarum</i>
Chipping sparrow	<i>Spizella passerina</i>
Field sparrow	<i>Spizella pusilla</i>
White-throated sparrow	<i>Zonotrichia albicollis</i>
Red-bellied woodpecker	<i>Centurus carolinus</i>
Wood thrush	<i>Hylocichla mustelina</i>
Red-eyed vireo	<i>Vireo olivaceus</i>
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>



BIRD SPECIES COMMONLY OBSERVED IN THE CEDAR RUN WATERSHED AREA (Continued)

<u>Common Name</u>	<u>Scientific Name</u>
Carolina chickadee	<i>Parus carolinensis</i>
Carolina wren	<i>Thryothorus ludovicianus</i>
Pine warbler	<i>Dendroica pinus</i>
Yellow-breasted chat	<i>Icteria virens</i>
American goldfinch	<i>Spinus tristis</i>

Sources: The Breeding Bird Survey; 1966, 1967, 1968, and 1969
United States Department of the Interior, Fish and Wildlife
Service, Bureau of Sport Fisheries and Wildlife and the
Breeding Bird Survey in Virginia, 1966-1968, Willet T.
Van Velzen.



AQUATIC INSECTS COLLECTED
CEDAR RUN WATERSHED

Order	Family	Genus	Cedar Run (Airlie) Site 3	Cedar Run (Auburn) Site 6	Licking Run Site 4	Mill Run Site 7	Turkey Run Site 1
Coleoptera	Dryopidae	<i>Helichus</i>	1	2		7	
Coleoptera	Elmidae	<i>Ancyronyx</i>		2			
Coleoptera	Elmidae	<i>Macronychus</i>	5	5			
Coleoptera	Gyrinidae	<i>Dineutus</i>	1				2
Coleoptera	Hydrophilidae	<i>Cymbiodyta</i>					1
Coleoptera	Hydrophilidae	<i>Hydrobius</i>	1				
Coleoptera	Psephenidae	<i>Psephenus</i>	2		6		
Coleoptera	Staphylinidae	-					1
Diptera	Tachinidae	-					1
Diptera	Tendipedidae	-	3				1
Ephemeroptera	Baetidae	<i>Baetis</i>	1				
Ephemeroptera	Baetidae	<i>Ephemerella</i>	6	1		4	
Ephemeroptera	Baetidae	<i>Isonychia</i>		3	6	18	
Ephemeroptera	Baetidae	<i>Paracloeodes</i>					2
Ephemeroptera	Heptageniidae	<i>Heptagenia</i>			2		
Ephemeroptera	Heptageniidae	<i>Stenonema</i>	5	10	19	4	14
Hemiptera	Corixidae	<i>Sigara</i>	3				
Hemiptera	Gerridae	<i>Gerris</i>					1
Hemiptera	Veliidae	<i>Microvelia</i>				1	
Megaloptera	Corydalidae	<i>Nigronia</i>	2	1	1		
Odonata	Aeshnidae	<i>Boyeria</i>				1	
Odonata	Coenagrionidae	<i>Argia</i>		1	2		
Plecoptera	Nemouridae	<i>Perlomyia</i>				1	
Plecoptera	Perlidae	<i>Acroneuria</i>				1	
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i>	6	2	10	11	
Trichoptera	Hydropsychidae	<i>Hydropsyche</i>	7	2	1	5	4
Trichoptera	Limnephilidae	<i>Drusus</i>					6
Trichoptera	Philopotamidae	<i>Chimarra</i>	18	1	9	7	
Trichoptera	Psychomyiidae	<i>Polycentropus</i>			1	1	

Identification by Dr. E. C. Turner, Jr., Professor of Entomology, Virginia Polytechnic Institute and State University, Blacksburg, Virginia



APPENDIX F

GLOSSARY

- Alluvium - A general term for all detrital deposits resulting from the operations of modern rivers, thus including the sediments laid down in riverbeds, flood plains, lakes, fans at the foot of mountain slopes, and estuaries.
- Benefits - The value of increased output of goods and services, the value of output resulting from external economics, and nonmonetary beneficial effects on environmental and social well-being resources.
- Biota - The flora and fauna of a region.
- Branch - A stream that flows into another usually larger stream. A tributary.
- Channel Improvement - The improvement of the flow characteristics of a channel by clearing, excavation, realignment, lining, or other means in order to increase its capacity. Sometimes used to connote channel stabilization.
- CL - The Unified Soil Classification System symbol for: Inorganic clays of low to medium plasticity.
- Conservation Land Treatment Measures - Construction and management-type practices normally planned, installed, and maintained by individuals or groups of landowners on their own lands to efficiently use and protect the land and water resources. These measures serve to reduce runoff, erosion, and sediment that would restrict land use, adversely affect the environment, and reduce the realization of maximum benefits from other existing and proposed measures.
- Costs - The value of all resources required for or displaced by proposed project measures, the value of losses in output resulting from external diseconomics, and nonmonetary adverse effects on environmental and social well-being resources.
- Drainage Area - The area draining into a stream at a given point.

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|--------------------------|--|
| Ecology | - The study of the interrelationships of living organisms to one another and to their surroundings. |
| Ecosystem | - Recognizable, relatively homogeneous units, including contained organisms, their environment, and all of the interactions among them. |
| Emergency Spillway | - A rock or vegetated earth waterway around a dam, built with its crest above the normally used principal spillway. Used to assist the principal spillway in conveying extreme amounts of runoff safely past the dam. |
| Emergency Spillway Crest | - The elevation at which, if exceeded, water starts flowing through the emergency spillway. |
| Erosion | - The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. Detachment and movement of soil or rock fragments by water, wind, ice, or gravity. |
| Eutrophication | - The normally slow aging process by which a lake evolves into a bog or marsh and ultimately assumes a completely terrestrial state and disappears. During eutrophication the lake becomes so rich in nutritive compounds, especially nitrogen and phosphorus, that algae and other microscopic plant life become super-abundant, thereby "choking" the lake, and causing it eventually to dry up. Eutrophication may be accelerated by many human activities. |
| Fauna | - The animal life of a region. |
| Fifty-year Flood | - See Frequency. |
| Flood | - In common usage, an event where a stream overflows its normal banks. |
| Flood Detention Pool | - The total volume of space provided between the elevations at which discharges begin through the principal and emergency spillways, less any capacity between these two elevations reserved for sediment and/or water supply. |

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1. General Information

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GLOSSARY (Continued)

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|--------------------------------|--|
| Flood Plain | - The land area bordering a river or stream which is subject to flooding. |
| Flood Plain Management | - Reducing potential flood losses by land treatment, nonstructural, and structural measures, or combinations thereof. |
| Floodwater Damage | - The point of beginning damage is that elevation above which floodwaters cause economic losses. |
| Floodwater Retarding Structure | - A single-purpose structure providing for temporary storage of floodwater and its controlled release. |
| Flora | - The plant life characteristic of a region. |
| Frequency | - An expression or measure of how often a hydrologic event of given size or magnitude should, on an average, be equaled or exceeded. For example, a 50-year frequency flood or 50-year flood should be equaled or exceeded in size, on the average, only once in 50 years. In drought or deficiency studies, it usually defines how many years will, on the average, be equal to or less than a given size or magnitude. |
| GM | - The Unified Soil Classification System symbol for silty gravels, gravel-sand-silt mixtures. |
| Ground Water | - The water in a saturated zone beneath the water table. A source of base flow in streams. |
| Impact Basin | - A reinforced concrete energy dissipator attached to the outlet of the principal spillway conduit to partially absorb, through impact, the water's energy before releasing it into the stream channel. |
| Intermittent Stream | - A stream which flows only part of the time, as after a rainstorm, during wet weather, or during only part of the year. |
| Main Stem | - The principal stream of a watershed to which all streams tributary to it feed. |

GLOSSARY (Continued)

- Mast - Nuts (as beechnuts and acorns) accumulated on the forest floor and often serving as food for wildlife or other animals.
- ML - The Unified Soil Classification System symbol for inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
- Multiple-Purpose (Use)- In the case of water resources, development of a particular water resource to serve two or more purposes simultaneously.
- Natural Streams - Those streams in an unaltered and unpolluted condition.
- Nonstructural Measures - Items such as flood insurance, flood warning systems, flood plain zoning or acquisition, flood proofing, relocating existing developments in flood-prone areas, building codes, and other land use controls or restrictions for achieving project objectives.
- One-hundred-Year Flood - See Frequency.
- Perennial Stream - A stream which flows throughout the year.
- Principal Spillway - A concrete or metal pipe or conduit used with a drop inlet dam or floodwater retarding structure. It conveys, in a safe and nonerosive manner, all ordinary discharges coming into a reservoir and all of an extreme amount that does not pass through the emergency spillway.
- Project Agreement - A written agreement entered into between the Soil Conservation Service and the sponsor(s) in which detailed working arrangements are established for the installation of works of improvement or other related purposes.
- Project Area - See Watershed.
- Project Measures - An undertaking for watershed protection; flood prevention; the conservation, development, utilization, and disposal of water; the conservation and proper utilization of land; or a combination thereof. The undertaking may consist of land treatment, nonstructural or structural measures, or a combination thereof.

GLOSSARY (Continued)

- Reach - A length of stream, selected for convenience in a study.
- Recreation Areas - Such areas as scenic, hunting and fishing, national and state forests, parks, monuments, refuges, drives, and campgrounds.
- SAF Outlet - That type of energy dissipator developed in the Saint Anthony Falls hydraulics laboratory.
- Sediment - Soil or mineral material transported by water and deposited in streams or other bodies of water.
- Sediment Pool - Reservoir storage provided for sediment, thus prolonging the usefulness of floodwater pools.
- SM - The Unified Soil Classification System symbol for silty sands, sand-silt mixtures.
- Storage - The impoundment in surface reservoirs or accumulation in underground reservoirs of water for later use or release.
- Structural Measures - Items such as dams, diversions, basins, dikes, pipe lines, conduits, channels, fences, pits, ponds, fish ladders, fish shelters, drops, checks, flumes, control gates, pumping plants, and outlet structures when the item are excavated or constructed with concrete, earth, masonry, metal, rock, or other materials, and vegetation which is a part of the structure.
- Ten-year-Flood - See Frequency.
- Tributary - A stream feeding a larger stream or lake.
- User fee - A monetary charge made upon direct beneficiaries (users) of a water project, designed to recover part or all of the installation cost plus operation and maintenance costs of the project.
- Watershed - All the area contained within a drainage divide above a specified point in a stream.
- Water Supply Pool - Reservoir storage provided between the elevations of the sediment pool and flood detention pool, used for municipal and industrial water supply purposes.

GLOSSARY (Continued)

Water Table - The upper surface of ground water.

List of abbreviations.

architects and engineers	A&E
acre feet	ac-ft
animal unit months	aum
biochemical oxygen demand	BOD
board foot	bd ft
cubic foot	cu ft
cubic feet per second	cfs
cubic feet/second/square mile	csm
dissolved oxygen	DO
formazin turbidity units	FTU's
micrograms per liter	ug/l
milligrams/liter	mg/l (ppm)
milliliter	ml
million gallons per day	mgd
parts per million	ppm
gallons per capita per day	gpcd
gallons per minute	gpm

WATER QUALITY DATA FOR CEDAR RUN WATERSHED 1/

SAMPLES TAKEN JUNE 10, 1974

State Code	Parameters	Sample Numbers						
		1	2	3	4	5	6	7
020	Coliform, Total/100 ml	46,000	930	24,000	15,000	930	430	4,300
055	Coliform, Fecal/100 ml	6,000+	900	1,600	3,900	300	100-	1,100
050	pH (Laboratory)	7.2	7.5	7.5	7.4	7.1	7.4	7.4
022	Alkalinity	39	40	54	41	30	37	36
024	Total Solids, Total	113	79	125	89	79	57	71
025	Volatile	40	18	35	27	38	31	31
026	Fixed	73	61	90	62	41	26	40
027	Suspended Solids, Total	63	7	6	2	5	4	4
028	Volatile	5	3	3	1	3	2	2
029	Fixed	58	4	3	1	2	2	2
067	Dissolved Solids, Total	50	72	119	87	74	53	67
035	Nitrogen, Total Kjeldahl	0.9	0.2	0.4	0.2	0.5	0.1	0.1
065	Phosphorus, Total	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-
064	Phosphorus, Ortho	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-
036	Ammonia mg/l as N	0.1	0.1-	0.1	0.1-	0.1-	0.1-	0.1-
037	Nitrite mg/l as N	0.07-	0.01-	0.07	0.07-	0.01-	0.07-	0.07-
038	Nitrate mg/l as N	0.63	0.2	0.93	0.58	0.15	0.24	0.3
019	BOD ₅	5	1	2	1	2	1	1
121, 122	Pesticides	DDE 0.07 ug/l	None detected	Atrazine 2.68 ug/l	DDE 0.01 ug/l	None detected	None detected	DDE, DDT 0.02, 0.02 ug/l
	Temperature °F	68°	80°	80°	75°	77°	76°	70°

Sample No. Struc. No.

1	#3	Airlie Property (Cedar Run)
2	#4	Rt. 602 bridge (Licking Run)
3	#5	Rt. 28 bridge (Owl Run)
4	#1	Rt. 602 bridge (Turkey Run)
5	#2	Rt. 602 bridge (Gupton Run)
6	#6	Rt. 602 bridge at Auburn (Cedar Run)
7	#7	Dirt road off north side of Rt. 670 (Mill Run)

1/ Bureau of Surveillance and Field Studies of the Commonwealth of Virginia State Water Control Board.



WATER QUALITY DATA FOR CEDAR RUN WATERSHED 1/

SAMPLES TAKEN AUGUST 15, 1974

State Code		Sample Numbers					
		1	2	3	4	5	6
020	Coliform, Total/100 ml	930	390	24,000	7,500	4,300	7,500
024	Total Solids, Total	93	126	254	122	114	66
025	Volatile	40	53	60	31	39	18
026	Fixed	53	73	194	91	75	48
027	Suspended Solids, Total	2	5	4	1	2	3
028	Volatile	1	2	3	1	1	1
029	Fixed	1	3	1	0	1	2
067	Dissolved Solids, Total	91	121	250	121	113	63
035	Nitrogen, Total Kjeldahl	0.1	0.3	2.1	0.5	0.1-	0.1 ⁹ ₁₂
065	Phosphorus, Total	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-
064	Phosphorus, Ortho	0.1-	0.1-	0.1-	0.1-	0.1-	0.1-
036	Ammonia mg/l as N	0.1-	0.1-	1.7	0.1-	0.1-	0.1-
037	Nitrite mg/l as N	0.01-	0.01-	0.01-	0.02	0.01-	0.01-
038	Nitrate mg/l as N	0.41	0.01	0.03	0.43	0.27	0.23
019	BOD ₅	1-	1	3	1	1-	1-
049	Turbidity FTU's	4.0	3.5	8.5	3.0	4.0	6.5
	Temperature °F	72°	83°	77°	75°	70°	73°

Sample No. Struc.No.

- 1 #3 Airlie Property (Cedar Run)
- 2 #4 Rt. 602 bridge (Licking Run)
- 3 #5 Dirt road off Rt. 616 (Owl Run)
- 4 #1 Rt. 602 bridge (Turkey Run)
- 5 Rt. 17 bridge (Cedar Run)
- 6 #7 Dirt road off Rt. 670 (Mill Run)

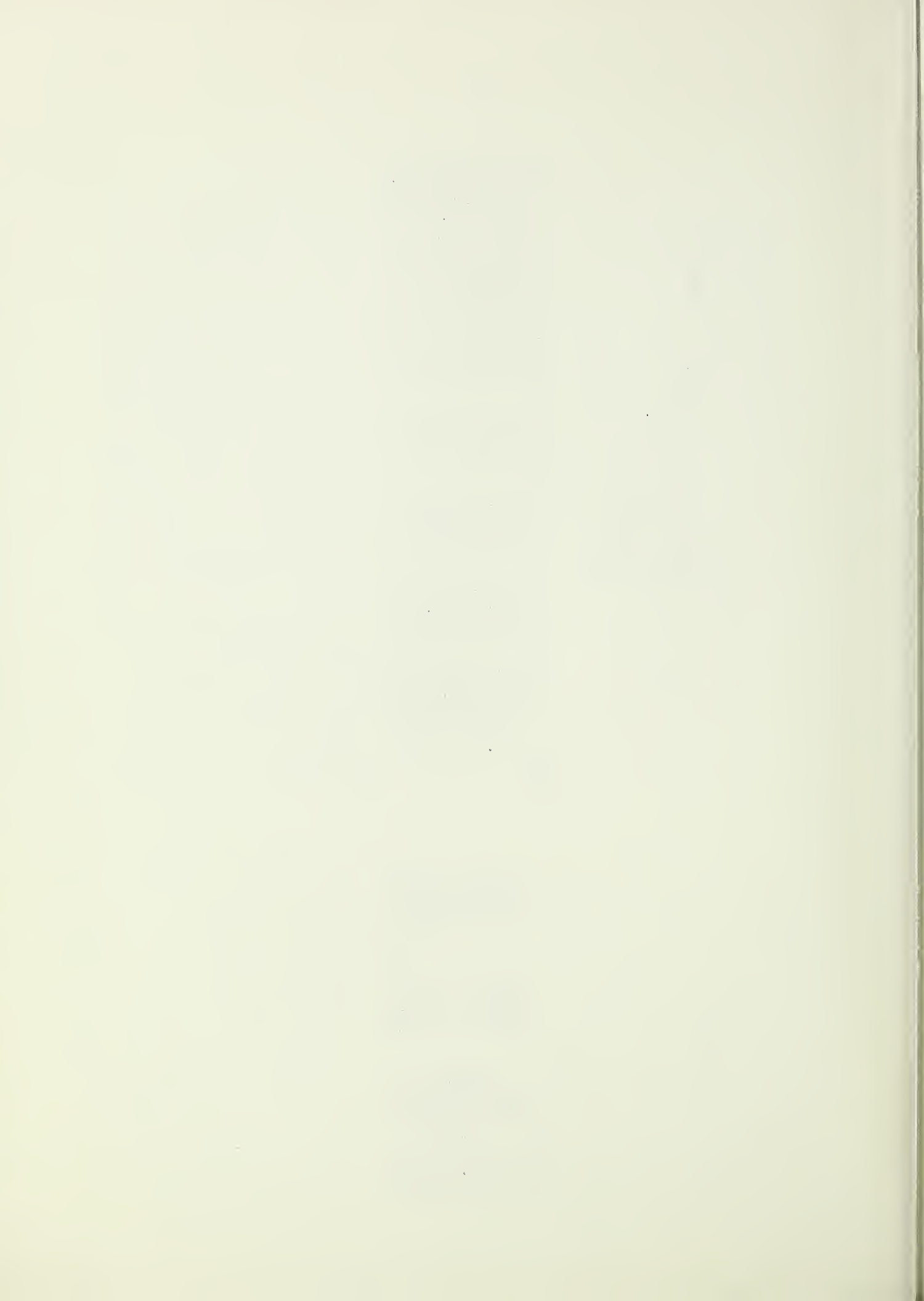
1/ Bureau of Surveillance and Field Studies of the Commonwealth of Virginia State Water Control Board.



STREET DATE 74/07/24

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 3A 37 30.0 077 31 00.0 4
 MARINE CORPS SCHOOL GUANTANAMO
 ST 7.5 NOKESVILLE
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PARAMETER	TOTAL	MG/L	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	REG DATE	END DATE
00610 NH3-N	TOTAL	MG/L	4	4.93750	33.6212	5.79838	12.8000	.230000	73/10/03	74/06/11
00615 NH2-N	TOTAL	MG/L	3	.032467	.001906	.043462	.083000	.005000	73/10/03	73/12/10
00620 NH3-N	TOTAL	MG/L	3	1.80333	3.63253	1.90542	3.95000	.310000	73/10/03	73/12/10
00625 TOT KJEL N	TOTAL	MG/L	4	9.45000	103.737	10.1851	27.0000	.400000	73/10/03	74/06/11
00630 NO2&NO3	N-TOTAL	MG/L	3	1.82333	3.58563	1.89358	3.95000	.320000	73/10/03	73/12/10
00665 PHOS-TOT	N-TOTAL	MG/L P	4	5.54999	6.46006	2.54165	8.40000	3.300000	73/10/03	74/06/11
00671 PHOS-DIS	PHOS-TOT	MG/L P	3	4.50000	4.52999	2.12438	6.80000	2.600000	73/10/03	73/12/10
50051 FL74	RATE	INST MGD	4	.124500	.000380	.019485	.152000	.106000	73/10/03	74/06/11
50053 FUNDUIT	FLOW-MGD	MONTHLY	4	.128000	.000256	.016001	.152000	.120000	73/10/03	74/06/11

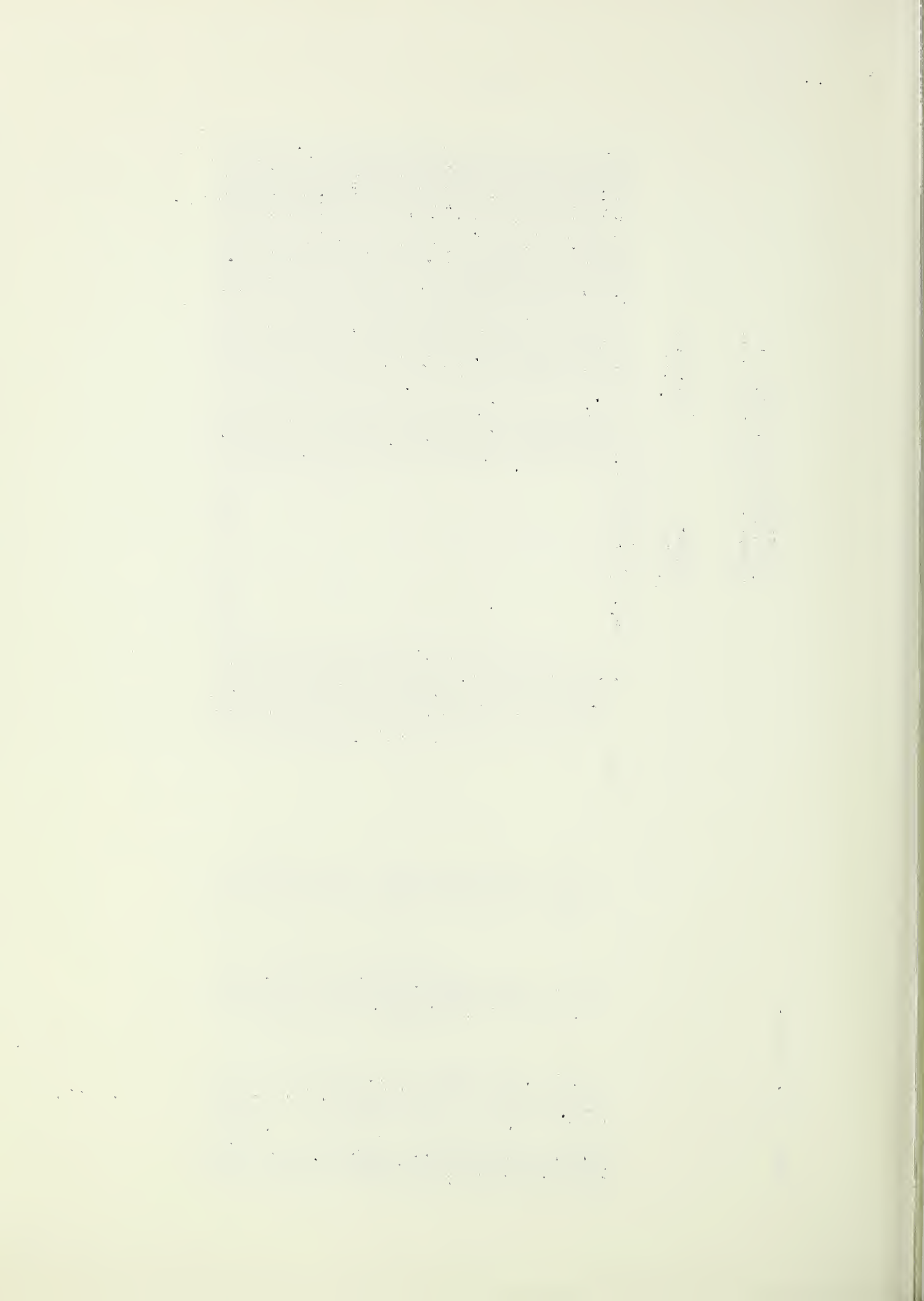


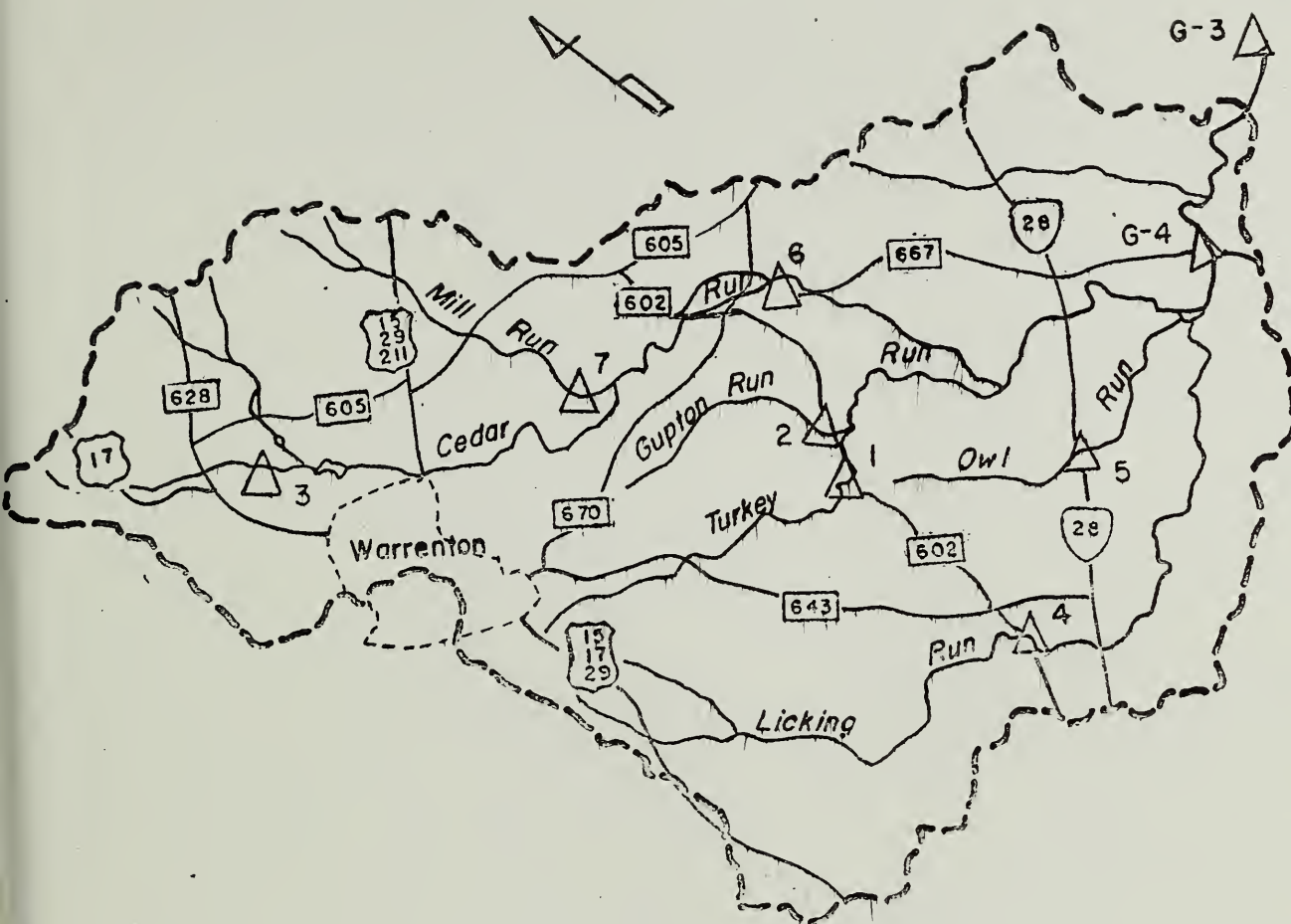
STORE DATE 74/07/26

01656000
 3A 38 12.0 077 37 31.0 2
 CEDAR RUN NEAR CATLETT, VA.
 51

112MRD
 0000 02111204

PARAMETER	TEMP PT-CO	AT 25C	UNIT	NUMBER	MEAN	VARIANCE	STAN DEV	MAXIMUM	MINIMUM	REG DATE	END DATE
00010 WATER			CEM	1	5.00000			5.00000	5.00000	68/03/06	68/03/06
00080 COLOR			UNITS	1	30.0000			30.0000	30.0000	68/03/06	68/03/06
00095 CONDUCTIV			MICROMHU	1	140.0000			140.0000	140.0000	68/03/06	68/03/06
00400 PH			SI	1	7.40000			7.60000	7.40000	68/03/06	68/03/06
00410 T ALK			MG/L	1	38.0000			38.0000	38.0000	68/03/06	68/03/06
00440 MCN3 ION			MG/L	1	46.0000			46.0000	46.0000	68/03/06	68/03/06
00445 C3 ION			MG/L	1	00.0000			00.0000	00.0000	68/03/06	68/03/06
00650 T PH			MG/L	1	140.0000			140.0000	140.0000	68/03/06	68/03/06
00900 TOT HARD			MG/L	1	52.0000			52.0000	52.0000	68/03/06	68/03/06
00902 NC HARD			MG/L	1	14.0000			14.0000	14.0000	68/03/06	68/03/06
00915 CALCIUM			MG/L	1	15.0000			15.0000	15.0000	68/03/06	68/03/06
00925 MGNSTUM			MG/L	1	3.40000			3.60000	3.40000	68/03/06	68/03/06
00930 SODIUM			MG/L	1	6.00000			6.40000	6.00000	68/03/06	68/03/06
00931 SODIUM			MG/L	1	40.0000			40.0000	40.0000	68/03/06	68/03/06
00932 PERCENT			HAITU	1	21.0000			21.0000	21.0000	68/03/06	68/03/06
00935 PTASTUM			X	1	1.20000			1.20000	1.20000	68/03/06	68/03/06
00940 CHI URIDE			MG/L	1	13.0000			13.0000	13.0000	68/03/06	68/03/06
00945 SULFATE			MG/L	1	16.0000			16.0000	16.0000	68/03/06	68/03/06
00950 FLUORIDE			MG/L	1	0.00000			0.00000	0.00000	68/03/06	68/03/06
00955 SILICA			MG/L	1	8.50000			8.50000	8.50000	68/03/06	68/03/06
01004 IRON			MG/L	1	150.000			150.000	150.000	68/03/06	68/03/06
70300 RESIDUE			C	1	92.0000			92.0000	92.0000	68/03/06	68/03/06
70301 NRS SOL			MG/L	1	89.0000			89.0000	89.0000	68/03/06	68/03/06
70303 NRS SOL			MG/L	1	130.000			130.000	130.000	68/03/06	68/03/06
71851 NITRATE			MG/L	2	1.000000	.719999	.848528	1.60000	.400000	68/03/06	69/04/09





LOCATION OF WATER QUALITY SAMPLES IN CEDAR RUN WATERSHED

1 thru 7 Samples by State Water Control Board

G-3 Stored Data
G-4

